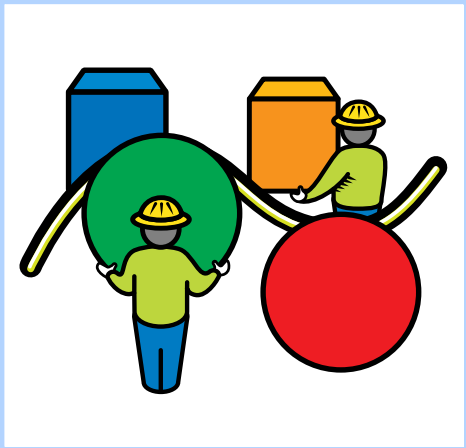
Allen-Bradley

DeviceNet™ Interface

(Catalog Number 1761-NET-DNI)

User Manual



Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss

Attention statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

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The information below summarizes the changes to this manual since the last printing.

To help you find new and updated information in this release of the manual, we have included change bars as shown to the right of this paragraph.

New Product Features and Compatibility with Series A DNI

ATTENTION: Series A DNI configurations *are not* compatible with the Series B DNI. You must manually re-enter the Series A parameters into the Series B DNI. This step is required because of the enhanced functionality of the Series B DNI.

Series B DNI provides the following new functions:

- The DNI can now initiate explicit messages over DeviceNet.
- The Series B DNI can accept messages to the new explicit assemblies at any time.
- The Standby/Operational parameter has been removed from the EDS file. The operating mode is now controlled by the I/O Scan Enable parameter.
- You will be able to configure the DNI parameters via the RS-232 port. This can be done using the DNI Configuration Software Utility version 2.001 (when available). For applications that use only DNIs, this will eliminate the need for configuration tools (such as RSNetWorx and the 1770-KFD Interface).
- Three new parameters have been added to the EDS file. The parameters are:

  – *DF1 Substitution Address* - The DF1 Substitution Address allows *any* DF1 device, such as the MicroView, to communicate to A-B controllers over DeviceNet.

  – *Input Split Point and Output Split Point* - The split point parameters are used to define how much data is configured as Master/Slave I/O and how much data is configured for explicit I/O assembly messaging.

Where to Find the New Information

The table below lists sections that document new features and additional information about existing features, and shows where to find this new information.

For This New Information	See
Where applicable, differences between the Series A and Series B DeviceNet Interface.	throughout the manual
References to using RSNetWorx configuration software.	chapters 2 and 6
New configuration parameters for DNI Series B (DF1 Substitution Address, Input Split Point, and Output Split Point)	chapter 5
DeviceNet Class Codes for DNI Series B	chapter 6
Description of Explicit Messaging and Routing Profile Configuration	chapter 8
Interface Basics, Terms and Abbreviations	glossary (this information was previously in the preface)

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- Who Should Use this Manual
- Purpose of This Manual
- Contents of this Manual
- Related Allen-Bradley Publications
- How to Get More Information
- Other Related Documentation
- Common Techniques Used in this Manual
- Allen-Bradley Support

Who Should Use this Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen-Bradley Controllers on DeviceNet.

You should have a basic understanding of Allen-Bradley programmable controllers and DeviceNet. You should understand programmable controllers and be able to interpret the ladder logic instructions required to control your application. If you do not, contact your local Allen-Bradley representative for information on available training courses before using this product.

Purpose of This Manual

This manual is a reference guide for the DeviceNet Interface (DNI). It describes the procedures you use to install and configure the DNI.

This manual:

- gives you an overview of the DNI
- explains the procedures you need to install, configure and commission a DNI

Contents of this Manual

Chapter	Title	Contents
	Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
1	Product Overview	Explains and illustrates the theory behind the DNI's operation. Covers hardware and software features.
2	Quick Start for Experienced Users	Serves as a Quick Start Guide for the DNI.
3	Operation	Describes the DNIs primary functions.
4	Installation and Wiring	Provides installation procedures and wiring guidelines.
5	DNI Configuration Parameters and Programming Notes	Provides information on configuring and programming the DNI.
6	Setup, Programming, and Troubleshooting	Describes start-up information, using programming software, normal operating states of the LED, fault conditions, and DeviceNet Class Codes
7	Application Examples	Examines applications using the DNI. Gives examples of the necessary ladder programming necessary to achieve the described result.
8	Explicit Messaging (DNI Series B Only)	Describes explicit messaging and routing profile configuration.
Appendix A	Specifications	Provides physical, electrical, environmental, and functional specifications for the DNI.
Glossary	Interface Diagram and Terms and Definitions	Provides terminology relating to the 1761-NET-DNI.

Related Allen-Bradley Publications

We recommend that you read the related publications listed below before starting up your control system.

For	Refer to this Document	Publication Number
Information on understanding and applying micro controllers.	MicroMentor	1761-MMB
Mounting instructions for the DeviceNet Interface	AIC+ Advanced Interface Converter and DeviceNet Interface Installation Instructions.	1761-5.11
Information on MicroLogix 1000 Controllers	MicroLogix 1000 Controllers User Manual	1761-6.3
Information on MicroLogix 1500 Controllers	MicroLogix 1500 Controllers User Manual	1764-6.1
Information on SLC Controllers	SLC 500™ Modular Hardware Style User Manual	1747-6.2
Information on PLC ® Controllers	PLC User Manual	1785-6.2.1
A reference manual that contains status file data and instruction set information	SLC 500 and MicroLogix 1000 Instruction Set Reference Manual	1747-6.15
Information on DeviceNet Manager	DeviceNet Manager Software User Manual	1787-6.5.3
Information on 1747 DeviceNet Scanner	1747 DeviceNet Scanner Installation Instructions 1747 DeviceNet Scanner User Manual	1747-5.8 1747-6.5.2
Information on 1771 DeviceNet Scanner	1771 DeviceNet Scanner Configuration Manual	1771-6.5.118
Planning and installing a DeviceNet cable system	DeviceNet Cable System Planning and Installation Manual	DN-6.7.2
In-depth information on grounding and wiring Allen-Bradley programmable controllers	Allen-Bradley Programmable Controller Grounding and Wiring Guidelines	1770-4.1
A glossary of industrial automation terms and abbreviations	Allen-Bradley Industrial Automation Glossary	AG-7.1
A complete listing of current Allen-Bradley documentation, including ordering instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages.	Allen-Bradley Publication Index	SD499

How to Get More Information

To obtain additional Allen-Bradley publications, you can:

- download a free electronic version from the internet:
  - www.ab.com/manuals
  - www.theautomationbookstore.com
  - www.ab.com/micrologix
- purchase a printed manual by:
  - contacting your local distributor or Rockwell Automation representative
  - visiting www.theautomationbookstore.com and placing your order
  - calling 1.800.963.9548 (USA/Canada) or 001.330.725.1574 (Outside USA/Canada)

Other Related Documentation

The following documents contain general information concerning DeviceNet and other relevant information. To obtain a copy, contact your local Allen-Bradley office or distributor.

For	Read This Document	Published By
Information on DeviceNet	DeviceNet Specifications	Open DeviceNet Vendor Association (ODVA) of Coral Springs, FL (www.odva.org)
An article on wire sizes and types for grounding electrical equipment	National Electrical Code	National Fire Protection Association of Boston, MA.

Common Techniques Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.

Important: We use this to call attention to helpful information.

Allen-Bradley Support

Allen-Bradley offers support services worldwide, with over 75 Sales/ Support Offices, 512 authorized Distributors and 260 authorized Systems Integrators located throughout the United States alone, plus Allen-Bradley representatives in every major country in the world.

Local Product Support

Contact your local Allen-Bradley representative for:

- sales and order support
- product technical training
- warranty support
- support service agreements

Technical Product Assistance

If you need to contact Allen-Bradley for technical assistance, please review the information in the Troubleshooting chapter first. Then call your local Allen-Bradley representative.

Your Questions or Comments on this Manual

If you have any suggestions for how this manual could be made more useful to you, please contact us at the address below:

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or visit our internet page at

http://www.ab.com/micrologix

Product Overview

Description

The DeviceNet Interface is a stand-alone, DIN rail or panel mounted, intelligent DeviceNet to DF1 protocol conversion device that allows existing DF1 devices to communicate on DeviceNet. The DF1 device is able to exchange I/O data with a Master device and is able to originate and receive DF1 encapsulated DeviceNet messages across DeviceNet.

The DNI provides a single DeviceNet connection point and a single RS-232 connection. The DeviceNet port is isolated from the DNI digital logic and RS-232 port.

The primary functions of the DNI are threefold:

- to collect or receive input data from the DF1 device connected on its RS-232 port and forward that data to a connected master on DeviceNet
- to monitor output data received from the DeviceNet master and write that data to the DF1 device
- to allow DF1 devices to send and receive messages across the DeviceNet network

Operating Modes

The DNI can be used in either or both of the following modes:

- peer-to-peer
- DeviceNet slave

Device Compatibility

The DNI can be used to interconnect the following devices:

- MicroLogix controllers
- DF1 Full Duplex compliant products, for example: PLC-5® programmable controllers, operator interface devices, and SLC 5/03™ and higher processors

Quick Start for Experienced Users

This chapter can help you to get started using the 1761-NET-DNI DeviceNet Interface (DNI). We base the procedures here on the assumption that you have an understanding of MicroLogix products. You should understand electronic process control and be able to interpret the ladder logic instructions required to generate the electronic signals that control your application.

Because this is a start-up guide for experienced users, this chapter *does not* contain detailed explanations about the procedures listed. It does, however, reference other chapters in this book where you can get more information.

If you have any questions or are unfamiliar with the terms used or concepts presented in the procedural steps, always read the *referenced chapters* and other recommended documentation before trying to apply the information.

Configuring Peer-to-Peer Messaging

To communicate with other controllers connected to DNI's on a DeviceNet network, follow these steps:

1. Unpack and mount the DNI.

2. Connect the DNI to the DeviceNet Network. When power is first applied to the DNI, it resides at node 63 on the network. (The DNI out-of-box configuration is defaulted to Autobaud; it synchronizes to the DeviceNet network baud rate.)

3. Connect a DF1 device to the DNI. (The DF1 connection automatically enters the Autobaud mode; it synchronizes to the attached DF1 device.)

4. Connect to the DNI with your network configuration tool (software such as the DNI Configuration Utility, RSNetWorx, or DeviceNet Manager) and set the DNI to the desired node number. This is called commissioning the DNI. See "Commissioning the DNI" on page 6-5 for more details.

Important: If your network consists entirely of DNIs (no master is present), you must disable Autobaud on at least one DNI. It is recommended that all DNIs be manually set to a specific baud rate. This is to prevent multiple DNIs from hunting for a baud rate at power-up.

5. To exchange data with other controllers over DeviceNet, configure a message instruction inside each controller's program. See "Programming Over DeviceNet" on page 3-5 for more information.

6. To send data to a specific controller on the network, enter the destination DNI's DeviceNet node address into the destination parameter of a message instruction. (Think of each DNI/Controller pair as one unit.)

Example:

To send a message from controller A (plugged into DNI number 5) to controller B (plugged into DNI number 10), controller A must have a message instruction with a destination node address of 10. See the application example "MicroLogix as I/O on DeviceNet" on page 7-1 for an example ladder program.

Configuring Master/Slave I/O

To configure a DNI connected to a MicroLogix 1000 controller as a slave device to a DeviceNet master, do the following:

Important: You must have the DNI's EDS (Electronic Data Sheet) file and bitmap file (or icon) loaded into your configuration software. See "DNI Software Files" on page 6-1 and "Setting Up Network Configuration Software" on page 6-3 for more information.

1. Unpack and mount the DNI.
2. Connect the DNI to the DeviceNet Network. When power is first applied to the DNI, it resides at node 63 on the network. (The DNI out-of-box configuration is defaulted to Autobaud; it synchronizes to the DeviceNet network baud rate.)
3. Connect to the DNI with your network configuration tool (software such as DeviceNet Manager or RSNetWorx) and set the DNI to the desired node number. This is called node commissioning.
4. Double-click on the DNI icon to open the DNI's EDS.
5. For DNI Series A: set DNI Mode (parameter 17) to Standby mode (0). For DNI Series B: set I/O Scan Enable (parameter 12) to disable (0) (default).
6. Click Save to Device.
7. To configure a MicroLogix 1000 controller as a slave device to a DeviceNet master, set the parameters as shown in the table on page 2-4.

Parameter Number		Description	Range	Default Value	For this Example, ENTER
Series A	Series B				
4	1	Input Size	Series A: 1 to 16 Series B: 1 to 32	1 word	2 words
Not Applicable	2	Input Split Point	1 to 32	1 word	2 words
5	3	Input Type	Bit or Integer File	Integer File	Integer File
6	4	Input Data File	3 to 254	7	7
7	5	Input Word Offset	0 to 254	0	90
8	6	Output Size	Series A: 1 to 16 Series B: 1 to 32	1 word	2 words
Not Applicable	7	Output Split Point	1 to 32	1 word	2 words
9	8	Output Type	Bit or Integer File	Integer File	Integer File
10	9	Output Data File	3 to 254	7	7
11	10	Output Word Offset	0 to 254	1	95
14	11	DF1 Device	0 to 3: 0: Other 1: PLC 2: SLC/ Other MicroLogix 3: MicroLogix 1000	3 = MicroLogix 1000	3 = MicroLogix 1000
3	12	DNI Series A: Data Enable DNI Series B: I/O Scan Enable (Polling Enable)	Disabled (0) or Enabled (1)	Disabled (0)	Enabled (1)
12	13	DF1 Heartbeat	Series A: 2 to 10 Series B: 1 to 10	2	2
13	14	Data Scan Delay (Polling Delay)	20 to 3000 ms	50 ms	100 ms
2	15	Message Timeout	0 to 2500 ms	0 ms	0 ms
Not Applicable	16	DF1 Substitute Address	0 to 64	64 = Disabled	64 = Disabled
15	17	DF1 Autobaud	Disabled (0) or Enabled (1)	Enabled (1)	Enabled (1)
16	18	DF1 Baud Rate	0 to 5: 0: 38,400 1: 19,200 2: 9600 3: 4800 4: 2400 5: 1200	Series A: 2 = 9600 Series B: 1 = 19,200	n/a
1	19	DeviceNet Autobaud	Disabled (0) or Enabled (1)	Enabled (1)	Enabled (1)
17	**Not Applicable**	DNI Mode	Standby (0) or Operational (1)	Operational (1)	Operational (1)

8. Click Modified Parameter, then OK.

9. Save to the configuration to the DNI.

In this configuration, the DNI provides two words (32 bits) of data. The data is scanned (read), starting at address N7:90 of the attached MicroLogix 1000 controller, at 100 msec intervals.

Data received (DeviceNet master output) is written to the MicroLogix 1000 controller whenever new (changed) data is detected by the DNI. Two words of data will be written to Integer file 7, starting at word 95.

Important: You must have the following rung programmed into the MicroLogix 1000 controller:

At this point, the DNI is configured to be a slave on DeviceNet, but it is not part of (owned by) a DeviceNet master/scanner.

To configure your DeviceNet scanner, refer to its manual. For the 1747-SDN, refer to the *1747 DeviceNet Scanner User Manual*, publication 1747-6.5.2. For the 1771-SDN, refer to the *1771 DeviceNet Scanner Configuration Manual*, publication 1771-6.5.118

Operation

Modes of Use

The DeviceNet Interface has three primary features.

- DeviceNet I/O
- Explicit Messaging
- Programming over DeviceNet network

DeviceNet I/O

Important: All input and output comments are referenced from the perspective of the DeviceNet Master.

The DNI is capable of being owned by a master on DeviceNet. This functionality on DeviceNet is part of the I/O class of services, and allows a master device to exclusively manage (own) another device's (a different node number) data and resources. This type of relationship is functionally the same as a PLC with remote I/O. A PLC uses the remote I/O chassis as distributed inputs and outputs. The master/slave relationship on DeviceNet is exactly the same, except it is being done over DeviceNet.

The amount of data available between devices that implement I/O master/slave services is determined by the design of each device, and is not a function of DeviceNet.

The DNI on DeviceNet is capable of handling 32 I/O words of data with a DeviceNet I/O master for DNI Series A (64 for DNI Series B). This is broken up into two data images: the input image and the output image.

Input Image

The input image is a configurable array of 16-bit data words. The image is configurable from 1 to 16 data words for DNI Series A (1 to 32 data words for DNI Series B). The actual data that resides in the input image is delivered to the DeviceNet master by one of three mechanisms:

- Polled: Where the DeviceNet Master sends a poll request with output data and the DNI responds with its current input data.
- COS (Change Of State): Where the DNI detects that data has changed within the input image and automatically sends the data to the DeviceNet Master.
- Cyclic: The DNI continuously sends the input image data to the master at a user/scanner-defined time interval, regardless of whether the data has changed.

Output Image

The output image is a configurable array of 16-bit data words. The image is configurable from 1 to 16 data words for DNI Series A (1 to 32 data words for DNI Series B). The actual data that resides in the output image is delivered to the DNI from the master by one of two mechanisms:

- Polled: Where the DeviceNet Master sends a poll request with output data and the DNI responds with its current input data.
- COS (Change Of State): Where the DeviceNet Master detects that data has changed within its output image and automatically sends the data to the DNI.
- Cyclic: The DNI continuously receives the output image data from the master at a user/scanner-defined time interval, regardless of whether the data has changed.

Network Configuration Software

All DNI I/O parameters are configured with software (such as the DNI Configuration Utility, RSNetWorx, or DeviceNet Manager) and stored as part of the network configuration. Configuration software is covered in "Setup, Programming, and Troubleshooting" on page 6-1, and the individual settings of the DNI are covered in "DNI Configuration Parameters and Programming Notes" on page 5-1 of this manual.

Explicit Messaging Services

The capabilities of each individual device determine what level of messaging is supported. The types of messaging supported are:

- I/O Assembly Messaging (DNI responds) (see below for more information)
- PCCC encapsulated DeviceNet Messaging (peer-to-peer) (see page 3-4 for more information)
- Explicit Assembly Messaging (DNI initiates, DNI Series B only) (see page 8-1 for more information)

I/O Assembly Messaging

Two conditions must be met to access the I/O assemblies:

- Data Enable (DNI Series A) or I/O Scan Enable (DNI Series B) must be enabled.
- The DF1 Device must be servicing the Heartbeat. See "DF1 Heartbeat" on page 5-15 for information on using the Heartbeat.

The following sections describe additional conditions based on the DNI Series.

DNI Series A

DNI Series A supports explicit messaging to the master I/O assemblies over DeviceNet at a minimal level. If the DNI is not owned by a DeviceNet master, the DNI responds to explicit messaging *gets* and accepts explicit messaging *sets* to the master I/O assembly. If the DNI is owned by a DeviceNet master, it responds to *gets*, but cannot accept *sets*. In either case, the data size must be 16 words, even if the I/O size is smaller. See page 6-12 to address DNI Series A assemblies.

The DNI Series A cannot perform *get*/*set* attribute I/O messaging over DeviceNet; it can only respond.

DNI Series B

DNI Series B provides the above described functionality, except the data size is equal to the configured I/O size. Additionally, DNI Series B can respond to explicit messages over DeviceNet to its explicit I/O assemblies whether it is owned by a DeviceNet master or not. See page 6-13 to address DNI Series B assemblies.

DNI Series B can also perform *get*/*set* services with its new DeviceNet messaging capability. See "Explicit Messaging Examples" on page 8-3.

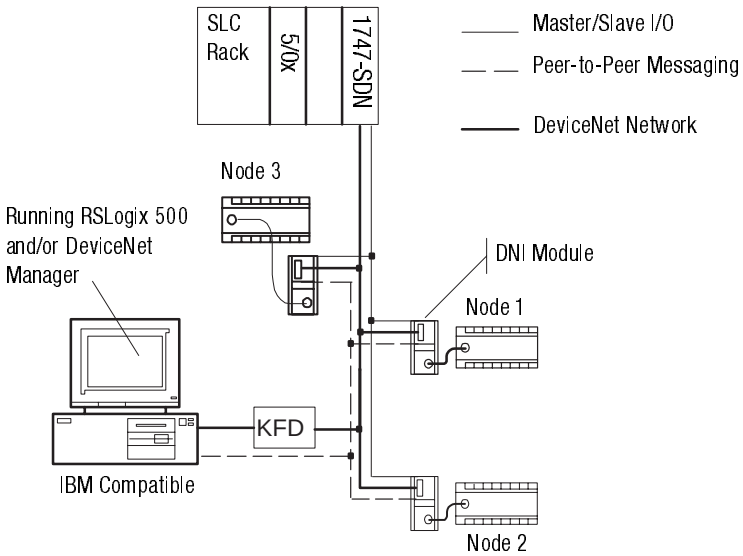
PCCC (Programmable Controller Communications Commands) DeviceNet Messaging/ DF1 (peer-to-peer)

PCCC messaging is how Allen-Bradley controllers (that have RS-232 ports) have communicated for many years. The DNI encapsulates the PCCC messages to allow PCCC messaging to operate over DeviceNet. This is an open (non-proprietary) protocol that can be implemented by anyone who needs to exchange information with an Allen-Bradley controller.

The DNI is capable of receiving the DF1 protocol, and sending or receiving it over DeviceNet. This enables any existing Allen-Bradley device that is capable of DF1 communications to an Allen-Bradley controller to use the DNI to communicate over DeviceNet.

For DNI Series A, the only stipulation is that the device has to be capable of entering a destination node address (For DNI Series B, this stipulation has been removed with the addition of the DF1 Substitute Address parameter.). The DNI uses the DF1 destination node address that is embedded in the DF1 packet to determine where on DeviceNet it needs to send the information.

This DF1-to-DeviceNet capability allows users to configure a peer-to-peer network. By programming standard ladder logic message instructions, with the destination address the same as the destination DNI (when not using DNI Series B address substitution), the message is routed across DeviceNet by the DNI. The following diagram illustrates the different types of messaging.

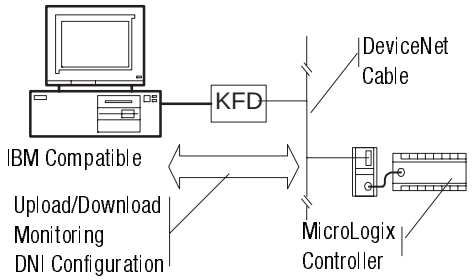


Also see Explicit Messaging (DNI Series B Only) on page 8-1 for DNI Series B.

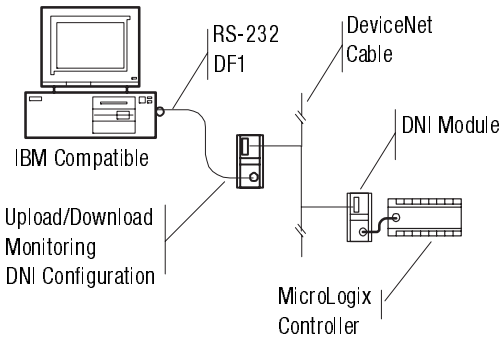
Programming Over DeviceNet

PCCC/DF1 messaging allows programming devices to connect to DeviceNet, and upload/download/monitor and even edit programs (if the controller attached to the destination DNI supports that functionality). Rockwell Software RSLogix 500/RSLinx (version 2 and higher) users can even connect directly to DeviceNet (using a KFD, PCD, or PCI interface).

Local Access to DeviceNet

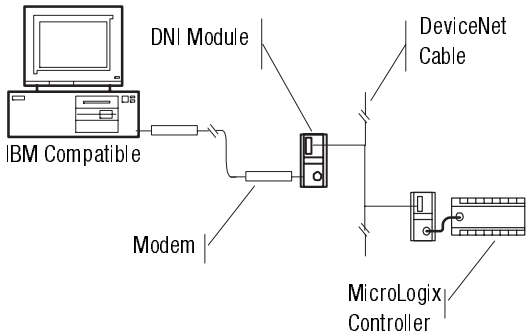


Or they can use a DNI connected to the computer's RS-232 port and upload/download to other controllers connected to DNIs on DeviceNet. See page 6-6 for programming procedures.



Remote Access to DeviceNet (Modems)

If users need to dial into a DeviceNet network and have access to controllers connected to DNIs, they can plug a DNI into a modem. Now users can dial into the modem and have access to all DNI/controllers from a remote site.



Installation and Wiring

European Communities (EC) Directive Compliance

This product has the CE mark and is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following additional directives.

EMC Directive

This product is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2 EMC — Generic Emission Standard, Part 2 — Industrial Environment
- EN 50082-2 EMC — Generic Immunity Standard, Part 2 — Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests. For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the Allen-Bradley publication Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1.

This equipment is classified as open equipment and must be mounted in an enclosure during operation to provide safety protection.

Safety Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D, or non-hazardous locations only.

ATTENTION: Explosion Hazard

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components unless power has been switched off and the area is known to be non-hazardous.
- Do not disconnect connectors unless power has been switched off and the area is known to be non-hazardous.

Use only the following communication cables and replacement connectors in Class I, Division 2, Hazardous Locations.

Environment Classification	Communication Cables
Class I, Division 2 Hazardous Environment	1761-CBL-PM02 Series C (or later)
	1761-CBL-HM02 Series C (or later)
	1761-CBL-AM00 Series C (or later)
	1761-CBL-AP00 Series C (or later)
	1761-RPL-00 DeviceNet Connector

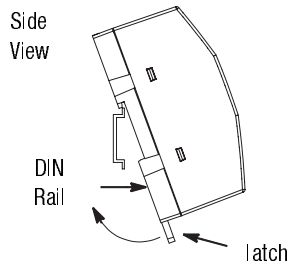
Mounting

The DNI can be mounted in the vertical or horizontal position. There are no spacing requirements except as necessary for DIN rail latch movement. See Appendix A for operating temperature specifications.

DIN Rail Mounting

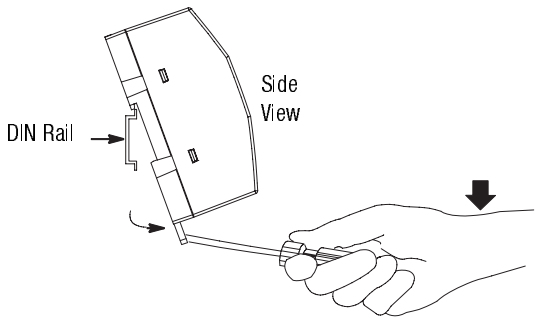
Installation

1. Mount your DIN rail.
2. Snap the DIN rail latch into the closed position.
3. Hook the top slot over the DIN rail.
4. While pressing the unit against the rail, snap the unit into position.



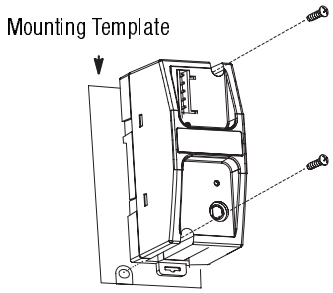
Removal

1. Place a screwdriver in the DIN rail latch at the bottom of the unit.
2. Holding the unit, pry downward on the latch until the unit is released from the DIN rail.



Panel Mounting

1. Remove the mounting template from Appendix A of this document.
2. Secure the template to the mounting surface.
3. Drill holes through the template.
4. Remove the mounting template.
5. Mount the unit.



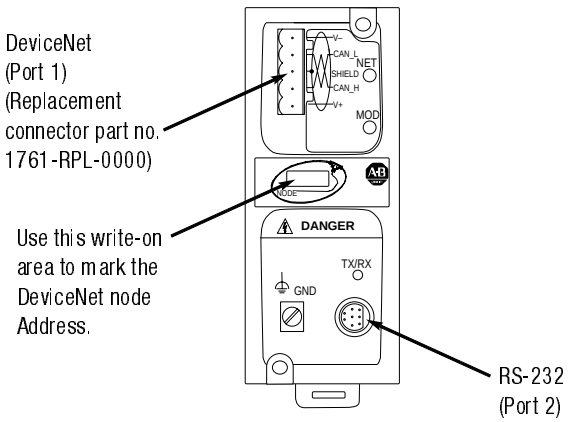
Network Port Wiring

DeviceNet Network

To properly design your DeviceNet network, you need Allen-Bradley publication DN-6.7.2, *DeviceNet Cable System Planning and Installation Manual*. This document provides design guidelines concerning wiring practices, connectors, grounding, power budgeting, etc.

This publication is available from your Allen-Bradley distributor, or from the Internet at **http://www.theautomationbookstore.com**.

Port Identification



Cable Selection Guide

RS-232 Devices

Port 2 of the DNI is an 8-pin mini-DIN RS-232 port that provides connection to DF1 compatible RS-232 devices. The table below describes the RS-232 compatible cables.

DNI Connected to:	Catalog Number	Use Cable
MicroLogix (all series)	1761-CBL-AM00 1761-CBL-HM02	Mini DIN to Mini DIN 45cm (17.7 in) 2m (6.5 ft.)
SLC 5/03, SLC 5/04, or SLC 5/05 Channel 0	1761-CBL-AP00 1761-CBL-PM02	Mini DIN to D-Shell 45cm (17.7 in) 2m (6.5 ft.)
PLC 5	1761-CBL-AP00 1761-CBL-PM02	Mini DIN to D-Shell 45cm (17.7 in) 2m (6.5 ft.)

DNI Configuration Parameters and Programming Notes

Information About DNI Series B

The following changes have been made which affect the EDS file.

- The Standby/Operational parameter has been removed from the EDS file. The operating mode is now controlled by the I/O Scan Enable parameter.
- Three new parameters have been added to the EDS file. The parameters are:
  - *DF1 Substitution Address* - The DF1 Substitution Address allows *any* DF1 device, such as the MicroView, to communicate to A-B controllers over DeviceNet.
  - *Input Split Point and Output Split Point* - The split point parameters are used to define how much data is configured as Master/Slave I/O and how much data is configured for explicit I/O assembly messaging.

ATTENTION: DNI Series A configurations are not compatible with DNI Series B. You must manually re-enter the Series A parameters into the Series B DNI. This step is required because of the enhanced functionality of DNI Series B.

Note: DNI Series A stopped shipping in June of 1999. DNI Series B started shipping in July of 1999.

EDS Parameters for the DNI

The following list shows the available parameters for configuring the DNI. Parameter definitions and usage information are provided in the sections following the table.

Important: When modifying most DNI parameters, you must first disable polling (Set the Data Enable parameter to disable for DNI Series A. Set the I/O Scan Enable parameter to disable for DNI Series B). You can enable polling after setting your configuration. For information on how to set up and modify parameters, see "Setup, Programming, and Troubleshooting" on page 6-1.

Parameter Type	Parameter Number		Description	Range	Default Value	For More Information
	Series A	Series B				
I/O	4	1	Input Size	Series A: 1 to 16 Series B: 1 to 32	1 word	5-3
I/O	**Not Applicable**	2	Input Split Point	1 to 32	1 word	5-4
I/O	5	3	Input Type	Bit or Integer File	Integer File	5-6
I/O	6	4	Input Data File	3 to 254	7	5-6
I/O	7	5	Input Word Offset	0 to 254	0	5-7
I/O	8	6	Output Size	Series A: 1 to 16 Series B: 1 to 32	1 word	5-8
I/O	**Not Applicable**	7	Output Split Point	1 to 32	1 word	5-9
I/O	9	8	Output Type	Bit or Integer File	Integer File	5-11
I/O	10	9	Output Data File	3 to 254	7	5-11
I/O	11	10	Output Word Offset	0 to 254	1	5-12
I/O	14	11	DF1 Device	0 to 3: 0: Other 1: PLC 2: SLC/ Other MicroLogix 3: MicroLogix 1000	3 = MicroLogix 1000	5-13
I/O	3	12	DNI Series A: Data Enable DNI Series B: I/O Scan Enable (Polling Enable)	Disabled (0) or Enabled (1)	Disabled (0)	5-14
I/O	12	13	DF1 Heartbeat	Series A: 2 to 10 Series B: 1 to 10	2	5-15
I/O	13	14	Data Scan Delay (Polling Delay)	20 to 3000 ms	50 ms	5-17
Messaging	2	15	Message Timeout	0 to 2500 ms	0 ms	5-18
Messaging	**Not Applicable**	16	DF1 Substitute Address	0 to 64	64 = Disabled	5-19
DF1	15	17	DF1 Autobaud	Disabled (0) or Enabled (1)	Enabled (1)	5-19
DF1	16	18	DF1 Baud Rate	0 to 5: 0: 38,400 1: 19,200 2: 9600 3: 4800 4: 2400 5: 1200	Series A: 2 = 9600 Series B: 1 = 19,200	5-20
DeviceNet	1	19	DeviceNet Autobaud	Disabled (0) or Enabled (1)	Enabled (1)	5-20
Device	17	**Not Applicable**	DNI Mode	Standby (0) or Operational (1)	Operational (1)	5-21

Input Size

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	4	1	Input Size	Series A: 1 to 16 Series B: 1 to 32	1

Important: For DNI Series B, you must also configure the Input Split Point. See page 5-4.

This parameter identifies the size, in words, of the data array that is read from the controller attached to the DNI's RS-232 port. The array may contain up to 16 (16-bit) words of data for DNI Series A (32 words for DNI Series B) from a contiguous block within the attached controller.

The first byte (byte 0) of the first word contains the status byte and is not available to the user. A sample of the data array is shown below:

Word		Input Image	
Series A	Series B		
0	0	Data (8 bits)	Status
1	1	Data Most Significant Byte (MSB)	Data Least Significant Byte (LSB)
2	2	Data MSB	Data LSB
3	3	Data MSB	Data LSB
↓	↓	↓	↓
14	30	Data MSB	Data LSB
15	31	Data MSB	Data LSB

Note: Byte 1 (MSB) of word 0 is available for user data.

Note: For information on the Status Byte (byte 0), see the Status Byte section on page 5-23.

Input Split Point

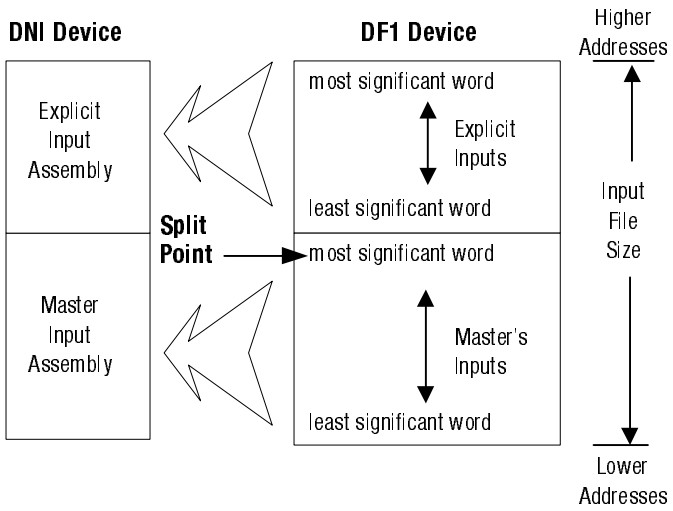
Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	n/a	2	Input Split Point	1 to 32	1

Important: The Input Split Point parameter cannot be used with DNI Series A.

The Input File Size within the DNI is configurable from 1 to 32 words. The Input Split Point defines how much data is configured as Master/Slave I/O and how much data is configured for explicit assembly messaging.

Organization of Input Data

The following diagram describes how the Split Point parameter affects the data in the DF1 Device. The split point represents the last word of the Master data. Words above the split point are Explicit data.



Input Split Point Example:

We need 4 (3.5 data + 0.5 status) words of slave data that the master will own, and we need to configure an additional 15 words so that other DeviceNet products can read data.

- Input Size = 19
- Input Split Point = 4

The DNI's input image will consist of:

	DNI's Input Image		
Word		**Instance ID**	
0	Master's Slave Data and Status	0x64	
1	Master's Slave Data		
2	↓		
3	Master's Slave Data		
Split Point			
4	Explicit Input Data	0x70	You can use 0x66 to access the entire configured explicit assembly.
5	↓	0x71	
6	↓	0x72	
7	↓	0x73	
8	↓	0x74	
9	↓	0x75	
10	↓	0x76	
11	↓	0x77	
12	↓	0x78	
13	↓	0x79	
14	↓	0x7A	
15	↓	0x7B	
16	↓	0x7C	
17	↓	0x7D	
18	Explicit Input Data	0x7E	

The minimum value allowed for the split point is 1, if the Input Size parameter is 32 (the maximum), the resulting range of explicit input words would be 0x70 to 0x8E.

See "Input Assembly Data (Explicit, Split Point, and Slave)" on page 6-14 for more information.

Input Type

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	5	3	Input Type	Bit or Integer File	Integer File

This parameter is used to identify the type of data to be read within the controller. The DNI supports data exchange with either bit or integer files.

Input Data File

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	6	4	Input Data File	3 to 254	7

This parameter is used to identify the data file to be read within the controller. Files within Allen-Bradley controllers are:

Controller	Input Data Files	Number Values
MicroLogix 1000	Bit	3
	Integer	7
SLC/Other MicroLogix	Bit	3, 10-255
	Integer	7, 9-255
PLC	Bit	3, 10-999
	Integer	7, 9-999

Note: The DNI can only access files 3 through 254.

Input Word Offset

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	7	5	Input Word Offset	0 to 254	0

This parameter identifies the starting word within the input file identified by the parameter Input Data File. The value entered is the first word of data that is read from the controller attached to the DNI. Based on the DF1 Device selected, the sizes of compatible data files within Allen-Bradley controllers are:

Controller	Input Data Files	File Sizes
MicroLogix 1000	Bit	32 Words
	Integer	105 Words
SLC/Other MicroLogix	Bit	255 Words
	Integer	255 Words
PLC	Bit	999 Words
	Integer	999 Words

Note: The DNI can only access data from words 0 through 254.

Important: You must have sufficient room in the file that you select. Make sure the Input Word Offset plus the Input Size does not exceed the boundary of the controller's data file. For example, a MicroLogix 1000 controller has 32 words in its bit file; therefore, you could not use a Input Word Offset of 30 and a Input Size of 5 because this exceeds the file size.

Important: If RSNetworx or DeviceNet Manager is used to configure/ commission the DNI, it is up to the user to select the correct values for:

- Input Size
- Input Split Point (DNI Series B only)
- Input Type
- Input Data File
- Input Word Offset

Only the DNI Configuration Software Utility performs checks on the information entered.

Output Size

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	8	6	Output Size	Series A: 1 to 16 Series B: 1 to 32	1

Important: For DNI Series B, you must also configure the Output Split Point. See page 5-9.

This parameter identifies the size, in words, of the data array that will be written to the controller attached to the DNI's RS-232 port. The array may contain up to 16 (16-bit) words of data for DNI Series A (32 words for DNI Series B) from a contiguous block within the attached controller.

The first byte (byte 0) of the first word contains the status byte and is not available to the user. A sample of the data array is shown below:

Word		Output Image	
Series A	Series B		
0	0	Data (8 bits)	Status
1	1	Data Most Significant Byte (MSB)	Data Least Significant Byte (LSB)
2	2	Data MSB	Data LSB
3	3	Data MSB	Data LSB
↓	↓	↓	↓
14	30	Data MSB	Data LSB
15	31	Data MSB	Data LSB

Note: Byte 1 (MSB) of word 0 is available for user data.

Note: For information on the Status Byte (byte 0), see the Status Byte section on page 5-23.

Output Split Point

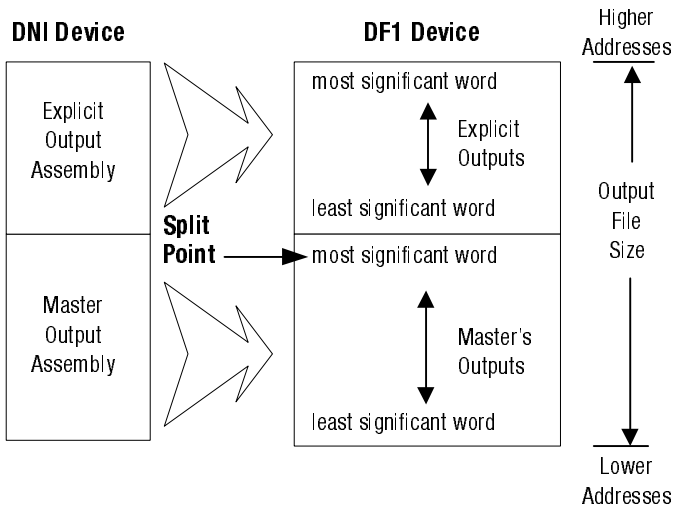
Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	n/a	7	Output Split Point	1 to 32	1

Important: The Output Split Point parameter cannot be used with DNI Series A.

The Output Size within the DNI is configurable from 1 to 32 words. The Output Split Point defines how much data is configured as Master/Slave I/O and how much data is configured for explicit assembly messaging.

Organization of Output Data

The following diagram describes how the Split Point parameter affects the data in the DF1 Device. The split point represents the last word of the Master data. Words above the split point are Explicit data.



Output Split Point Example

We need 4 (3.5 data + 0.5 status) words of slave data that the master will own, and we need to configure an additional 15 words so that other DeviceNet products can write data.

- Output Size = 19
- Output Split Point = 4

The DNI's output image will consist of:

	DNI's Output Image		
Word		**Instance ID**	
0	Master's Slave Data and Status	0x65	
1	Master's Slave Data		
2	↓		
3	Master's Slave Data		
Split Point			
4	Explicit Output Data	0x90	You can use 0x67 to access the entire configured explicit assembly.
5	↓	0x91	
6	↓	0x92	
9	↓	0x93	
8	↓	0x94	
9	↓	0x95	
10	↓	0x96	
11	↓	0x97	
12	↓	0x98	
13	↓	0x99	
14	↓	0x9A	
15	↓	0x9B	
16	↓	0x9C	
17	↓	0x9D	
18	Explicit Output Data	0x9E	

The minimum value allowed for the Split Point is 1. If the Output Size is 32 (maximum), the resulting range of explicit output words would be 0x90 to 0xAE.

See "Output Assembly Data (Explicit, Split Point, and Slave)" on page 6-15 for more information.

Output Type

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	9	8	Output Type	Bit or Integer File	Integer File

This parameter is used to identify the type of data to be written to the controller. The DNI supports data exchange with either bit or integer files.

Output Data File

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	10	9	Output Data File	3 to 254	7

This parameter is used to identify the target data file where data will be written within the controller. Files within Allen-Bradley controllers are:

Controller	Output Data Files	Number Values
MicroLogix 1000	Bit	3
	Integer	7
SLC/Other MicroLogix	Bit	3, 10-255
	Integer	7, 9-255
PLC	Bit	3, 10-999
	Integer	7, 9-999

Note: The DNI can only access files 3 through 254.

Output Word Offset

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	11	10	Output Word Offset	0 to 254	1

This parameter identifies the starting word within the output file identified by the Output Data File parameter. The value entered is the first word of data that is written to the controller attached to the DNI. Based on the DF1 Device selected, the sizes of compatible data files within Allen-Bradley controllers are:

Controller	Output Data Files	File Sizes
MicroLogix 1000	Bit	32 Words
	Integer	105 Words
SLC/Other MicroLogix	Bit	255 Words
	Integer	255 Words
PLC	Bit	999 Words
	Integer	999 Words

Note: The DNI can only access data from words 0 through 254.

Important: You must have sufficient room in the file that you select. Make sure the Output Word Offset plus the Output Size does not exceed the boundary of the data file. For example, a MicroLogix 1000 controller has 32 words in its bit file; therefore, you could not use a Output Word Offset of 30 and a Output Size of 5 because this exceeds the file size.

Important: If RSNetworx or DeviceNet Manager is used to configure/ commission the DNI, it is up to the user to select the correct values for:

- Output Size
- Output Split Point (DNI Series B only)
- Output Type
- Output Data File
- Output Word Offset

Only the DNI Configuration Software Utility performs checks on the information entered.

Device Type

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	14	11	DF1 Device	0 to 3: 0: Other 1: PLC 2: SLC/ Other MicroLogix 3: MicroLogix 1000	3 = MicroLogix 1000

Select the device connected to the DNI's RS-232 port. If you are connecting an Allen-Bradley controller as a DeviceNet I/O slave device, this selection is used by the DNI to determine the type of communication commands used to read and write data.

To achieve the best communications performance you should use the following combinations:

RS-232 Device	DF1 Device Value	File Type	File Number
MicroLogix 1000	3	N (integer)	7
SLC 5/03 or higher Other MicroLogix (i.e. MicroLogix 1500)	2	N (integer)	9

Note: If you do not want to communicate with these specific data files, RS-232 port communications throughput will suffer marginally.

I/O Scan Enable

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	3	12	DNI Series A: Data Enable DNI Series B: I/O Scan Enable (Polling Enable)	Disabled (0) or Enabled (1)	Disabled (0)

This parameter enables the DNI to scan/exchange I/O data with DF1 devices. If the DNI is being used in an application that does not use this feature, disabling this parameter improves the DNI's messaging performance. When this parameter is disabled, PCCC messaging still operates.

Important: Enable this parameter to use explicit messaging to assemblies.

Important: When modifying most DNI parameters, you must first disable polling (Set the Data Enable parameter to disable for DNI Series A. Set the I/O Scan Enable parameter to disable for DNI Series B). You can enable polling after setting your configuration. For information on how to set up and modify parameters, see "Setup, Programming, and Troubleshooting" on page 6-1.

DF1 Heartbeat

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	12	13	DF1 Heartbeat	Series A: 2 to 10 Series B: 1 to 10	2

The DF1 data heartbeat is used to detect a valid communications path between the controller and the DNI and also to detect if the connected controller is scanning its ladder logic. The heartbeat is enabled whenever:

- DNI Series A: Data Enable is enabled and DNI Mode is operational
- DNI Series B: I/O Scan Enable is enabled

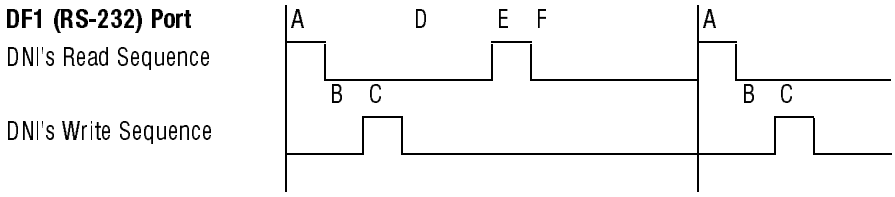
The heartbeat consists of a bit in the first byte (byte 0, bit 7) of the data packet that is exchanged with the controller. The DNI sets this bit in the output data being sent to the controller. The user must move this bit, using ladder logic, to the corresponding bit position in the input data area where the bit is then read from the controller by the DNI.

At the heartbeat rate, once the DNI sees the bit return in its correct state, it toggles the bit to the opposite state and sends it back to the controller (this is a round robin process). If the bit state does not change, it is detected as a communication/controller error and reported to the DNI master as a zero-length packet. Refer to your scanner or master controller documentation to determine how this is detected in the master logic.

This bit should also be monitored by the controller attached to the DNI, and if the bit does not change in the output image at the heartbeat rate, it can be used within the controller to detect a problem with the DNI/DeviceNet Master.

DF1 Heartbeat Rotation Example

The value entered for the heartbeat determines how often the DNI will rotate the heartbeat bit. The table below illustrates the heartbeat rotation with the default setting of two (heartbeat checked on every other read).



- A - DNI gets (reads) data from controller
- B - DNI checks heartbeat and toggles bit
- C - DNI sets (writes) data to controller
- D - Data Scan Delay period
- E - DNI gets (reads) data from controller
- F - Data Scan Delay (period)

Important: The example above does not represent accurate timing relationships.

Looking at the above list the following issues need to be considered:

- B is done inside the DNI and is completed extremely fast, typically less than a millisecond.
- D is the only consistent time variable; the DNI waits for the amount of time specified by the Data Scan Delay parameter.
- A, C, and E are variable; the time associated with each is dependent on a number of factors: baud rate, communication errors/retries, etc.
- If you are monitoring the heartbeat bit in the controller to determine communications integrity, as a general rule, multiply the Data Scan Delay by the DF1 Heartbeat plus 1 to determine the preset time value for the heartbeat timer.
- DF1 Heartbeat determines how many input reads are done between heartbeat checks and toggles (step B). When the DF1 Heartbeat is set to 2, this occurs on every other read; when the DF1 Heartbeat is set to 3, this occurs on every third read.

See the application example "DF1 Heartbeat (Bit 7)" on page 5-24 and "MicroLogix as I/O on DeviceNet" on page 7-1 for more information about using the DF1 Heartbeat.

Data Scan Delay

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
I/O	13	14	Data Scan Delay (Polling Delay)	20 to 3000 ms	50 ms

When Data Enable (parameter 3) is enabled (DNI Series A) or I/O Scan Enable (parameter 12) is enabled (DNI Series B), the value entered for Data Scan Delay defines the amount of time that the DNI will delay between communications. This value does not identify how often communications take place; it defines the delay between the completion (end) of one communication sequence and the beginning of the next.

Important: It is important not to set this value too low. Setting Data Scan Delay too low limits access to the controller from other devices on the network. If this value is too low, programming terminals, other controllers, and any other devices attempting to communicate with this controller are unable to due so, because the RS-232 port communications link bandwidth is being consumed by the I/O scan feature of the DNI.

Important: To move data from the controller to the DeviceNet master as quickly as possible, use the DNI's input messaging feature. See input messaging on page 5-22.

See the application example "MicroLogix as I/O on DeviceNet" on page 7-1 for more information about using the Data Scan Delay.

Message Timeout

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
Messaging	2	15	Message Timeout	0 to 2500 ms	0 ms

The Message Timeout is the amount of time that a DeviceNet explicit connection is held open after message completion. The Message Timeout allows the DNI to hold open a connection with another device over DeviceNet. (On DeviceNet, a connection means that two devices have established a communications path.) Each time communications need to occur between devices, a connection is established; when the communications have completed, the connection is released.

The number of connections that each device can support depends on the design/capabilities of each device. The DNI has five connections available for messaging. The Message Timeout allows the user to tune how a connection behaves after communications have completed. You may want to dedicate a connection to a specific node/device to maintain a connection. This reduces the amount of time needed to re-establish communications with the device.

It is recommended that this value only be changed (from the default) if communications with another node is constant. When the timeout is set, the connection is not released back to the system until the timeout expires (where 0 ms means close immediately after use).

Important: An open connection between devices over DeviceNet does not limit or inhibit communications over the network. If two devices maintain a connection, other devices continue to communicate.

DF1 Substitute Address

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
Messaging	n/a	16	DF1 Substitute Address	0 to 64	64 = Disabled

Important: The DF1 Substitute Address parameter cannot be used with DNI Series A.

If the device that is connected to the DNI is not capable of selecting a DF1 destination address of 0 to 63, by entering a value in this parameter, the DNI automatically routes all DF1 communications to this address with the following exceptions:

- Responses to poll requests are sent to the configured address.
- COS/Cyclic I/O data messages are sent to the configured device.

For example, when using a MicroView operator interface over DeviceNet, DF1 Substitute Address defines the device (node number) that the MicroView exchanges data with.

Note: A value of 64 (default) disables this feature.

DF1 Autobaud

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
DF1	15	17	DF1 Autobaud	Disabled (0) or Enabled (1)	Enabled (1)

The DNI's RS-232 baud rate is set up to automatically synchronize to the attached RS-232 device. If you want to lock the RS-232 baud rate, disable this parameter. If this parameter is disabled (0), the DNI's RS-232 port baud rate is set to the value specified by the DF1 Baud Rate parameter.

DF1 Baud Rate

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
DF1	16	18B	DF1 Baud Rate	0 to 5: 0: 38,400 1: 19,200 2: 9600 3: 4800 4: 2400 5: 1200	Series A: 2 = 9600 Series B: 1 = 19,200

This parameter defines the baud rate for the RS-232 port when DF1 Autobaud is disabled.

DeviceNet Autobaud

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
DeviceNet	1	19	DeviceNet Autobaud	Disabled (0) or Enabled (1)	Enabled (1)

The DNI automatically synchronizes to the DeviceNet Network that it is attached to (125K, 250K, or 500K baud). To disable this feature, set DeviceNet Autobaud to disable (0).

When set to disable, the DNI uses the DeviceNet baud rate configured during the node commissioning process. Therefore, when the DeviceNet Autobaud is disabled, the baud rate the DNI is set to may be different than the DeviceNet Network baud rate.

Important: When parameter is disabled (0), the baud rate is set using the node commissioning utility in your network configuration software, and is not set by the DNI's EDS file.

Important: Power cycle the DNI for baud rate changes to take effect.

DNI Mode

Parameter Type	Parameter Number		Description	Range	Default Value
	Series A	Series B			
Device	17	n/a	DNI Mode	Standby (0) or Operational (1)	Operational (1)

Important: The DNI Mode parameter only applies to DNI Series A. For DNI Series B, the operating mode is controlled by the I/O Scan Enable parameter.

This parameter defines the mode of the DNI. You must set this mode to Standby (0) when you want to change a number of DNI parameters. Once you have made the necessary changes, set this value to Operational (1).

Programming Notes

Input Messaging

The DNI is capable of accepting an unsolicited Input Data Message from the DF1 device. This capability allows the controller to update the DNI's input data whenever it detects a change in its input data. With this capability, a user can increase the value of the data scan delay; this reduces the amount of communications traffic over the RS-232/DF1 port, but still maintains very high I/O throughput performance.

To utilize this feature, simply program a message instruction in the controller with a destination address of 254. The DNI accepts the message and when it sees the 254 address (which is invalid on DeviceNet), it recognizes that the message is input data. All data received by message instruction with address 254 is automatically routed to the DNI's input data area.

See the application example "MicroLogix as I/O on DeviceNet" on page 7-1 for more information about input messaging.

Input Messaging Considerations

- You cannot write to a specific word in the DNI's input area.
- The destination offset value in the controller's message instruction is ignored. Data always starts at word 0.
- The message length must equal the size specified by the Input Size parameter. For DNI Series B only, both the Master's Slave data and the Explicit Assembly are considered to be input. For more information, see:
  - "Input Split Point" on page 5-4.
  - "Input Assembly Data (Explicit, Split Point, and Slave)" on page 6-14.
- For MicroLogix 1000 controllers, use N7 as the destination file type. For other controllers, see the recommended file number on page 5-13.

Status Byte

The first byte (bits 0 to 7) of the first word of I/O data is set aside as status information. The second byte (bits 8 to 15) of the first word of I/O is available for user data. The DNI Input/Output Image is shown below:

Word		Input/Output Image	
Series A	Series B		
0	0	Data (bits 8 to 15)	**Status Byte (bits 0 to 7)**
1	1	Data Most Significant Byte (MSB)	Data Least Significant Byte (LSB)
2	2	Data MSB	Data LSB
3	3	Data MSB	Data LSB
↓	↓	↓	↓
14	30	Data MSB	Data LSB
15	31	Data MSB	Data LSB

Input Status to Master Device

The Input Status Byte provides the following information:

Function	n/a	Output Buffer Overdrive	n/a					
Bit Number	7	6	5	4	3	2	1	0

Output Buffer Overdrive (Bit 6, written by the DNI)

This bit is set (1) when Master Outputs arrive at a rate faster than the DNI can forward the data to the DF1 device. When the Buffer Overdrive bit is set, the output image is being overwritten before it can be sent to the DF1 device. To resolve this, limit the data production rate in the scanner until this bit stays clear (0).

Output Status to DF1 Device

The Output Status Byte provides the following information:

Function	Heartbeat	Valid Data	DeviceNet Node Number					
Bit Number	7	6	5	4	3	2	1	0

DeviceNet Node Number (Bits 0 - 5)

Whenever the DNI sets (writes) output data to the DF1 device, these six bits contain the DeviceNet address that the DNI is assigned on DeviceNet. If the user program needs to know what node number its DNI is configured for, program a masked move (MVM) instruction in the ladder logic to move the node number out of this byte. The MVM should have:

- its destination address located in the controller's integer file
- a masked value of 003F
- the source address should match the location identified by the Output Word Offset parameter.

DeviceNet Valid Data (Bit 6)

The DNI sets this bit (1) to the DF1 device whenever it detects that the DNI's DeviceNet master is on-line/operational. The ladder logic program in the controller should monitor this bit and take any necessary control action.

DF1 Heartbeat (Bit 7)

The DNI writes the status of this bit to the controller, using the interval set by the DF1 Heartbeat parameter. The DNI expects the controller to move the status of bit 7 from the output data area to the input data area. The easiest way to accomplish this is by programming an XIC instruction in series with an OTE instruction as shown in the following example.

Example:

With the starting output word at N7:95 (Output Word Offset), and the starting input word at N7:90 (Input Word Offset), you need to program this rung in the controller's program to move the heartbeat bit.

Your program should also monitor N7:95/7 for activity. If activity is lost, it represents a problem with the connection to the DNI, or the DNI has some type of error or problem.

See the application example "MicroLogix as I/O on DeviceNet" on page 7-1 for more information about using the DF1 Heartbeat.

Setup, Programming, and Troubleshooting

DNI Software Files

Required Files

To configure the DNI as an I/O slave device on DeviceNet, you may need to obtain two software files. These two files provide your network configuration software with the information it needs to interface with the DNI.

DNI Series A Information

RSNetWorx and DeviceNet Manager (version 3.0 and higher) include the files necessary for DNI Series A.

DNI Series B Information

To configure the Series B DNI, you must have the Series B DNI EDS file installed in your DeviceNet configuration software. RSNetWorx DeviceNet Network Management software version 2.11.36 or higher includes all Series B DNI files. You can also download the new files from **http://www.ab.com/micrologix**. The following table shows the old and new file filenames:

1761-NET-DNI	File Description	File Name
Series B	DNI Electronic Data Sheet	1761DNI3.EDS
	DNI Configuration Software Utility	DNIUTIL1.EXE (Rev. 2.0 or higher)
	DNI Icon for Configuration Software	1761DNI.ICO or 1761DNIB.BMP
Series A	DNI Electronic Data Sheet	1761DNI2.EDS
	DNI Configuration Software Utility	DNIUTIL1.EXE
	DNI Icon for Configuration Software	1761DNI.BMP

ATTENTION: DNI Series A configurations are not compatible with DNI Series B. You must manually re-enter the Series A parameters into the Series B DNI. This step is required because of the enhanced functionality of DNI Series B.

Note: DNI Series A stopped shipping in June of 1999. DNI Series B started shipping in July of 1999.

File Descriptions

File	Description
DNI Electronic Data Sheet	This is a text file that is compatible with A-B network configuration software. This file, along with the 1761DNI.BMP (or 1761DNI.ICO) file, must be installed using the EDS import utility built into your network configuration software.
DNI Icon for Configuration Software	This is a bitmap that is used to graphically illustrate the DNI in your configuration software. For RSNetWorx, use 1761BMP.ICO. For DeviceNet Manager, use 1761DNI.BMP. The DNI Configuration Software Utility includes the DNI icon files.
DNI Configuration Software Utility	The 1761-NET-DNI configuration utility can be used to configure all 1761-NET-DNI parameters, and also to commission (set node number and baud rate) of other DeviceNet compatible products for operation on a DeviceNet Network. This utility makes configuring a 1761-NET-DNI easier through the use of intuitive screens and Wizards.

Obtaining the Files

These files are routinely incorporated into your network configuration software. If they are not in your version of configuration software, these files are available from a number of sources:

- Local Allen-Bradley distributor
- Local Allen-Bradley Sales Office
- Via the Internet at **http://www.ab.com/micrologix**

Setting Up Network Configuration Software

To configure the DNI, you must set up your network configuration software and follow the configuration procedures. The initial set up is only performed once. After the files have been saved by your network configuration software, they are stored on the computer.

Setting Up DNI Configuration Software Utility

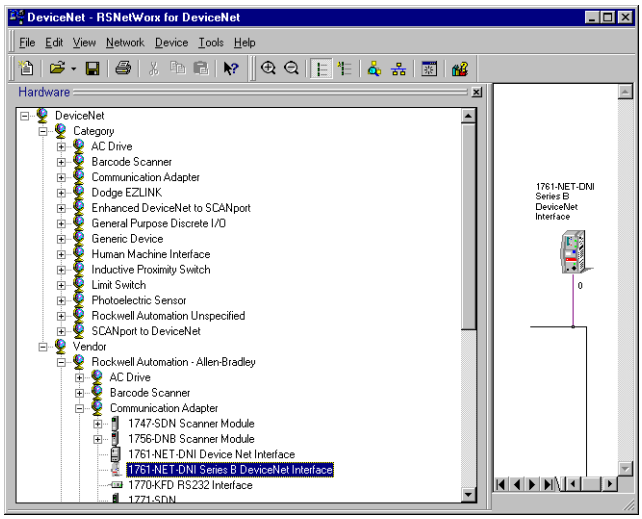
No initial set up is required to use the DNI Configuration Software Utility.

Setting Up RSNetworx

With RSNetworx open, install 1761DNI2.EDS for DNI Series A (1761DNI3.EDS for DNI Series B) and 1761DNI.ICO using the EDS install utility (in the Utilities menu of RSNetworx).

To load both DNI files into RSNetWorx:

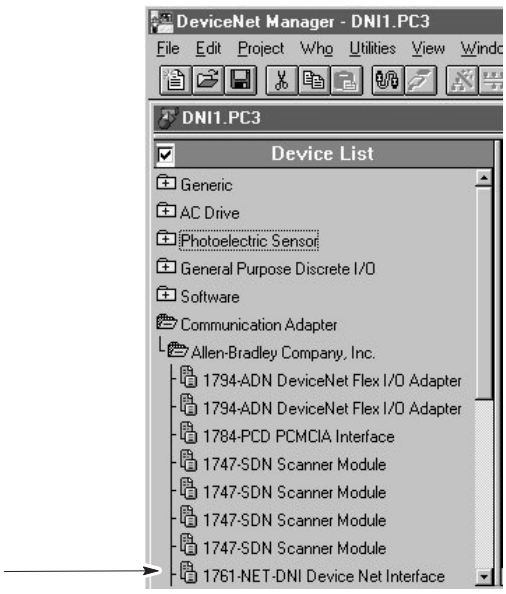
1. Start RSNetWorx.
2. With RSNetWorx open, select the View Tools Menu.
3. Select EDS Wizard
4. Select Register an EDS file and follow the prompts. RSNetWorx is now set up to recognize and configure the DNI.
5. To locate 1761-NET-DNI in RSNetWorx file list, double-click on the following folders:
   - Rockwell Automation - Allen-Bradley Company
   - Communications Adapter



Setting Up DeviceNet Manager

With DeviceNet Manager open, install 1761DNI2.EDS for DNI Series A (1761DNI3.EDS for DNI Series B) and 1761DNI.BMP for DNI Series A (1761DNIB.BMP for DNI Series B) using the EDS install utility (in the Utilities menu of DeviceNet Manager). To load both DNI files into DeviceNet Manager:

1. Start DeviceNet manager.
2. With DeviceNet manager open, select the Utilities Menu.
3. Select Install EDS Files.
4. Locate 1761DNI2.EDS for DNI Series A (1761DNI3.EDS for DNI Series B) on your computer.
5. Highlight and load electronic data sheet into the software.
6. Confirm the prompt to attach a bitmap.
7. Locate 1761DNI.BMP (1761DNIB.BMP for DNI Series B) on your computer.
8. Highlight and load bitmap into the software. DeviceNet manager is now set up to recognize and configure the DNI.
9. To locate 1761-NET-DNI in DeviceNet managers file list, double-click on the following folders:
   - Communications Adapter
   - Allen-Bradley Company



Commissioning the DNI

Your configuration software handles all interface issues for connection to a DNI over DeviceNet. You use exactly the same procedures to connect to a DNI as you do any other DeviceNet product.

The DNI draws power from the DeviceNet connector. When the DNI is connected to a DeviceNet network for the first time, the DNI out-of-box configuration is:

- Node: 63
- Baud: Autobaud

Commissioning is accomplished with network configuration software such as DNI Configuration Utility, RSNetWorx, or DeviceNet Manager. There are two parameters that need to be set during the commissioning process: the Node Address and Baud Rate.

Important: If the tool you are using to commission the DNI is connected to the DNI with a point-to-point connection (Example: a 1770-KFD connected directly to the DNI without any other devices), the commissioning tool must not be set to Autobaud. The DNI out-of-box configuration is set to Autobaud. If both devices are set to Autobaud, they may hunt and never find each other.

Note: For DNI Series B, you will be able to commission the DNI via the RS-232 port. This can be done using the DNI Configuration Software Utility version 2.001 (when available). For applications that use only DNIs, this will eliminate the need for configuration tools (such as RSNetWorx and the 1770-KFD Interface). You can simply use an RS-232 cable.

1. Connect the DNI to a PC through a DeviceNet interface device (i.e. 1770-KFD, 1784-PCD, etc.).
2. Execute mini-who screen to locate the target DNI.
3. If DeviceNet Autobaud is disabled, enter the DeviceNet baud rate.
4. Enter the node address to be configured.
5. Apply changes. Status is shown in status bar.
6. Save changes.

Important: Configuring the baud rate is needed only when DeviceNet Autobaud is disabled. The default (out-of-box) setting for DeviceNet Autobaud is “enabled”.

Important: The new baud rate takes effect on power cycle or when DNI is reset. Use caution when changing the baud rate on an active network.

Programming Over DeviceNet

Computer with DNI

The DNI provides the ability to upload/download/monitor the ladder logic program of controllers connected to a DNI on the network. To accomplish this:

1. Connect a commissioned DNI to the RS-232 port on a computer (as shown under Local Access to DeviceNet on page 3-5).
2. Set the communications in the configuration software to DF1 Full Duplex.
3. Select the DeviceNet address of the destination DNI. You can now upload/download/monitor over the network. The functionality over the network is determined by the destination device.

Example:

If the destination device is a MicroLogix 1000 controller, you cannot perform on-line editing. If the destination device is an SLC 5/03 or later or PLC, you can edit on-line.

Important: With a computer connected to a DNI, you cannot configure devices on the DeviceNet network. You cannot use the DNI as a replacement for a 1770-KFD.

Computer on DeviceNet

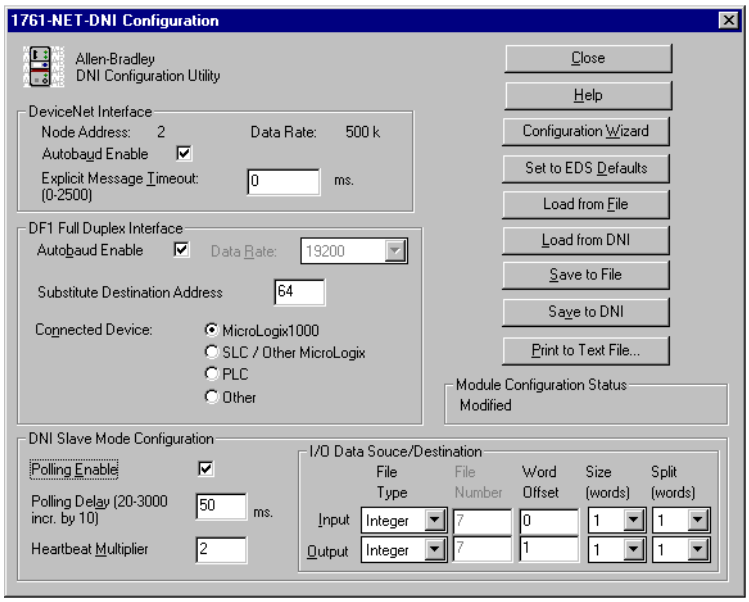
To upload/download/edit controller programs directly over DeviceNet (using a 1770-KFD, 1784-PCD, 1784-PCID or equal), you must have RSLinx version 2.O or newer.

1. Open RSLinx, and select Configure Drivers.
2. Select DeviceNet Driver from the list.
3. Click Add New.
4. Open your configuration software and make sure it recognizes and is configured to use RSLinx DeviceNet driver.
5. In the configuration software's communications section, select the destination DNI that you want to connect to.

Modifying DNI Parameters

Using DNI Configuration Utility to Modify Parameters

Use the main configuration to set or change any of the DNI parameters. Disable Polling Enable while you are making changes. When you are finishing, click Save to File and Save to DNI.

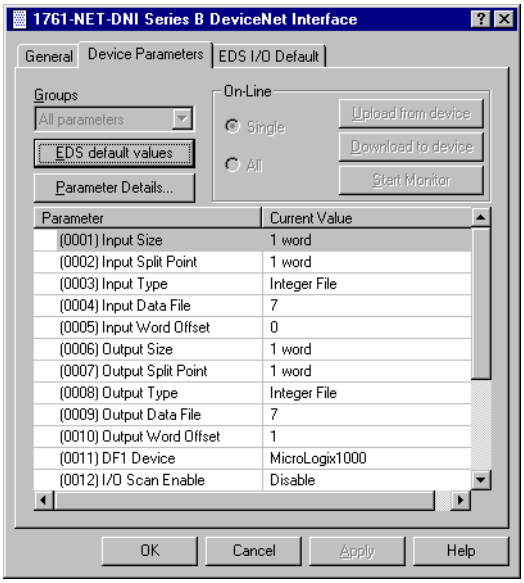


Using RSNetWorx to Modify Parameters

Once a DNI is placed on the network, double-click to open the EDS file. All adjustable parameters that configure the DNI for operation are set up through this configuration utility. The illustration below shows the RSNetworx Device Configuration screen with each DNI configurable parameter.

To configure any of the parameters, perform this procedure.

1. Highlight the parameter.
2. Click the Modify Parameter button, or double-click on the parameter.
3. For DNI Series A, set DNI mode to Standby. For DNI Series B, set I/O Scan Enable to Disable.
4. Change the parameter data as needed.
5. For DNI Series A, set DNI mode to Operational. For DNI Series B, set I/O Scan Enable to Enable.
6. For more detailed information click on *Help*. Once a parameter is changed or after all parameters are changed, click Download to Device.

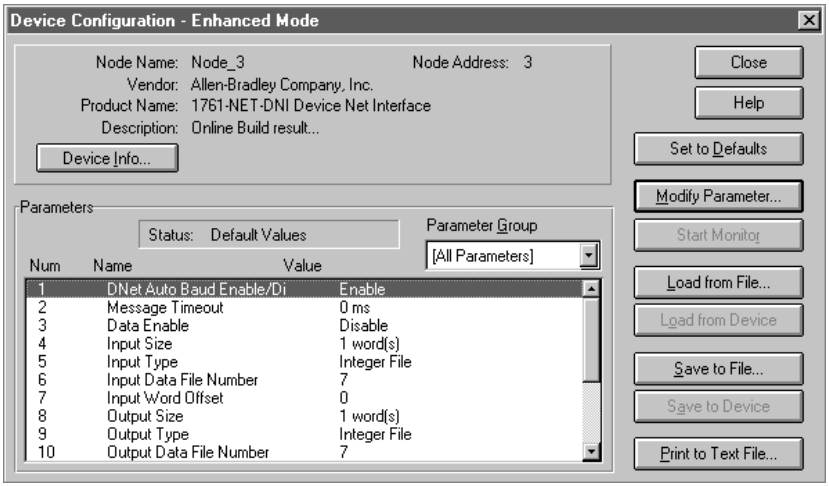


Using DeviceNet Manager to Modify Parameters

Once a DNI is placed on the network, double-click to open the EDS file. All adjustable parameters that configure the DNI for operation are set up through this configuration utility. The illustration below shows the DeviceNet Manager Device Configuration screen with each DNI configurable parameter.

To configure any of the parameters, perform this procedure.

1. Highlight the parameter.
2. Click the Modify Parameter button, or double-click on the parameter.
3. For DNI Series A, set DNI mode to Standby. For DNI Series B, set I/O Scan Enable to Disable.
4. Change the parameter data as needed.
5. For DNI Series A, set DNI mode to Operational. For DNI Series B, set I/O Scan Enable to Enable.
6. For more detailed information, click on *Help*. Once a parameter is changed or after all parameters are changed, click Save to Device.



Troubleshooting

LED Indicators

The DeviceNet Interface has three LED indicators:

LED	Color
Module Status LED	bicolor - red/green
Network Status LED	bicolor - red/green
RS-232 LED	green

MOD LED (Module Status LED)

The module status LED provides information specific to the DNI.

LED Condition	DNI State	Problem/Indication
Off	Not Powered	The device may not be powered or firmware unable to run.
Green (1)	• DNI Series A: Device Operational • DNI Series B: Device Scanning	The device is operating in a normal condition.
Flashing Green (1)	• DNI Series A: Device in Standby • DNI Series B: Device Not Scanning	• For DNI Series A only, the device may be in Standby Mode; set to operational. • For DNI Series B, I/O Scan (Polling Enable) may need to be set (1).
Flashing Red	Minor Fault	Recoverable fault. • DNI may need to be commissioned (the DNI will not operate when set to the out-of-box defaults). • The device needs commissioning due to missing, incomplete, or incorrect configuration. • EEPROM may be corrupt, re-commission the DNI.
Red	Unrecoverable Fault	The device has an unrecoverable fault which requires the power to be cycled, or the DNI may need to replaced.
Flashing Red-Green	Device Self Testing	The device is in self test and should only occur at power up or reset.

(1) Normal condition.

NET LED (Network Status LED)

The network status LED provides information specific to the DeviceNet network.

LED Condition	DNI State	Problem/Indication
Off	Not Powered/Not On-Line	DNI is not on-line. • DNI has not completed the Dup_MAC_ID test yet. • DNI may not be powered.
Flashing Green (1)	On-Line, Not Connected	DNI has passed the Dup_MAC_ID test, is on-line, but has not established connections to other nodes.
Green (1)	On-Line, Connected	The DNI has one or more valid established connections. This can be either I/O or Messaging
Flashing Red	Connection Time-Out	I/O connection(s) are in the timed-out state.
Red	Critical Link Failure	Failed communication device. The DNI has detected an error that has rendered it incapable of communicating on the network (Bus-Off error). If the error is Duplicate MAC ID, the DNI only communicates via the Group 4 off-line connection set.
Flashing Red-Green	Communication Faulted	A specific communication fault recovery stage or self-test.

(1) Normal condition.

RS-232 Port LED Indicator

The DNI has a green LED next to the RS-232 connector to provide communications activity status. The LED is lit whenever data is being transmitted or received. When communications are occurring, this LED will appear to be flashing.

Fault Conditions

The following table defines causes of faults in the DNI.

MOD LED	NET LED	Fault Condition	DeviceNet Standard Fault	Available Recovery Options
Solid Red	Not Applicable	Self-Test Failure	Module - Major Unrecoverable Fault	Power Cycle
Flash Red	Not Applicable	Invalid Configuration Parameter	Module - Minor Recoverable Fault	Modify Invalid Parameter
Flash Red	Not Applicable	EEPROM Invalid	Module - Major Recoverable Fault	Re-commission the DNI.
Not Applicable	Solid Red	Duplicate Node Detected	Communication Fault	Power Cycle, Group 4 Fault Recovery
Not Applicable	Solid Red	Bus-Off Error	Communication Fault	Power Cycle, set bus-off attribute of DeviceNet object to 1.

DNI Series A DeviceNet Class Codes

Identity Object

Class Code: 0x01

Service Name	Service Code
Get Attribute Single	0x0E
Set Attribute Single	0x10
Reset	0x05

Instance = 0x01

Name	Attribute	Data	Access	Value
Vendor ID	0x01	UINT	Get	1
Device Type	0x02	UINT	Get	12
Product Code	0x03	UINT	Get	2
Revision	0x04	STRUCT of:	Get	
Major Revision		USINT	Get	1
Minor Revision		USINT	Get	2
Status	0x05	WORD	Get	N/A
Serial Number	0x06	UDINT	Get	N/A
Product Name	0x07	SHORT_STRING	Get	1761-NET-DNI
DNI Mode (parameter 17)	0x64	BOOL	Get/Set	0 or 1

Slave I/O Assembly Data

Class Code: 0x04

Name	Access	Instance		Data Attribute
		Type	Value	
Input Assembly	Get/Set	Input	100 (64H)	3
Output Assembly	Get/Set	Output	101 (65H)	3

DNI Series B DeviceNet Class Codes

Identity Object

Class Code: 0x01

Service Name	Service Code
Get Attribute Single	0x0E
Set Attribute Single	0x10
Reset	0x05

Instance = 0x01

Name	Attribute	Data	Access	Value
Vendor ID	0x01	UINT	Get	1
Device Type	0x02	UINT	Get	12
Product Code	0x03	UINT	Get	32
Revision	0x04	STRUCT of:	Get	
Major Revision		USINT	Get	2
Minor Revision		USINT	Get	1
Status	0x05	WORD	Get	N/A
Serial Number	0x06	UDINT	Get	N/A
Product Name	0x07	SHORT_STRING	Get	1761-NET-DNI

Input Assembly Data (Explicit, Split Point, and Slave)

Class Code: 0x04

Name	Access	Instance		Data Attribute
Inputs		**Type**	**Value**	
Slave Assembly	Get/Set	Input	100 (64h)	3
Input Split Point (1)				
Explicit Assembly (2)	Get/Set	Input	102 (66h)	3
Explicit word 0	Get/Set	Input	112 (70h)	3
Explicit word 1	Get/Set	Input	113 (71h)	3
Explicit word 2	Get/Set	Input	114 (72h)	3
Explicit word 3	Get/Set	Input	115 (73h)	3
Explicit word 4	Get/Set	Input	116 (74h)	3
Explicit word 5	Get/Set	Input	117 (75h)	3
Explicit word 6	Get/Set	Input	118 (76h)	3
Explicit word 7	Get/Set	Input	119 (77h)	3
Explicit word 8	Get/Set	Input	120 (78h)	3
Explicit word 9	Get/Set	Input	121 (79h)	3
Explicit word 10	Get/Set	Input	122 (7Ah)	3
Explicit word 11	Get/Set	Input	123 (7Bh)	3
Explicit word 12	Get/Set	Input	124 (7Ch)	3
Explicit word 13	Get/Set	Input	125 (7Dh)	3
Explicit word 14	Get/Set	Input	126 (7Eh)	3
Explicit word 15	Get/Set	Input	127 (7Fh)	3
Explicit word 16	Get/Set	Input	128 (80h)	3
Explicit word 17	Get/Set	Input	129 (81h)	3
Explicit word 18	Get/Set	Input	130 (82h)	3
Explicit word 19	Get/Set	Input	131 (83h)	3
Explicit word 20	Get/Set	Input	132 (84h)	3
Explicit word 21	Get/Set	Input	133 (85h)	3
Explicit word 22	Get/Set	Input	134 (86h)	3
Explicit word 23	Get/Set	Input	135 (87h)	3
Explicit word 24	Get/Set	Input	136 (88h)	3
Explicit word 25	Get/Set	Input	137 (89h)	3
Explicit word 26	Get/Set	Input	138 (8Ah)	3
Explicit word 27	Get/Set	Input	139 (8Bh)	3
Explicit word 28	Get/Set	Input	140 (8Ch)	3
Explicit word 29	Get/Set	Input	141 (8Dh)	3
Explicit word 30	Get/Set	Input	142 (8Eh)	3

(1) The split point determines the size of the slave assembly and the explicit assembly. If the input size (parameter 1) is set to 32, and the split point (parameter 2) is the minimum size (1), the remaining words are explicit inputs. The example above illustrates the maximum amount of explicit inputs that can be configured. For more information about using the split point parameter, see Input Split Point on page 5-4 or Output Split Point on page 5-9.

(2) A *get* of this instance will return the entire set of Explicit Assembly Data.

Output Assembly Data (Explicit, Split Point, and Slave)

Class Code: 0x04

Name	Access	Instance		Data Attribute
Outputs		**Type**	**Value**	
Slave Assembly	Get/Set	Output	101 (65h)	3
Output Split Point (1)				
Explicit Assembly (2)	Get/Set	Output	103 (67h)	3
Explicit word 0	Get/Set	Output	144 (90h)	3
Explicit word 1	Get/Set	Output	145 (91h)	3
Explicit word 2	Get/Set	Output	146 (92h)	3
Explicit word 3	Get/Set	Output	147 (93h)	3
Explicit word 4	Get/Set	Output	148 (94h)	3
Explicit word 5	Get/Set	Output	149 (95h)	3
Explicit word 6	Get/Set	Output	150 (96h)	3
Explicit word 7	Get/Set	Output	151 (97h)	3
Explicit word 8	Get/Set	Output	152 (98h)	3
Explicit word 9	Get/Set	Output	153 (99h)	3
Explicit word 10	Get/Set	Output	154 (9Ah)	3
Explicit word 11	Get/Set	Output	155 (9Bh)	3
Explicit word 12	Get/Set	Output	156 (9Ch)	3
Explicit word 13	Get/Set	Output	157 (9Dh)	3
Explicit word 14	Get/Set	Output	158 (9Eh)	3
Explicit word 15	Get/Set	Output	159 (9Fh)	3
Explicit word 16	Get/Set	Output	160 (A0h)	3
Explicit word 17	Get/Set	Output	161 (A1h)	3
Explicit word 18	Get/Set	Output	162 (A2h)	3
Explicit word 19	Get/Set	Output	163 (A3h)	3
Explicit word 20	Get/Set	Output	164 (A4h)	3
Explicit word 21	Get/Set	Output	165 (A5h)	3
Explicit word 22	Get/Set	Output	166 (A6h)	3
Explicit word 23	Get/Set	Output	167 (A7h)	3
Explicit word 24	Get/Set	Output	168 (A8h)	3
Explicit word 25	Get/Set	Output	169 (A9h)	3
Explicit word 26	Get/Set	Output	170 (AAh)	3
Explicit word 27	Get/Set	Output	171 (ABh)	3
Explicit word 28	Get/Set	Output	172 (ACh)	3
Explicit word 29	Get/Set	Output	173 (ADh)	3
Explicit word 30	Get/Set	Output	174 (AEh)	3

(1) The split point determines the size of the slave assembly and the explicit assembly. If the output size (parameter 6) is set to 32, and the split point (parameter 7) is the minimum size (1), the remaining words are explicit outputs. The example above illustrates the maximum amount of explicit outputs that can be configured. For more information about using the split point parameter, see Input Split Point on page 5-4 or Output Split Point on page 5-9.

(2) A *get* of this instance will return the entire set of Explicit Assembly Data.

Application Examples

All examples are for illustration and information purposes only. Because of the many variables and requirements associated with any particular installation, Rockwell Automation cannot assume responsibility or liability for the actual use based on the examples and diagrams.

MicroLogix as I/O on DeviceNet

MicroLogix controllers are *incapable* of being true slave I/O products. But, they are capable of behaving like slave I/O and more by adding logic (user program). This example turns a MicroLogix controller into an I/O block on DeviceNet. The MicroLogix input data is sent up to the DeviceNet master as input data, and the DeviceNet master output data is sent to the MicroLogix outputs.

The example logic is a user program that monitors the communications link between the MicroLogix and the DeviceNet master and makes sure it is operational. If problems occur with the communications link, the MicroLogix controller turns off the outputs. If the connection is restored, the controller recovers and behaves like an I/O block.

If you would prefer to have the MicroLogix maintain the outputs when a communications fault is detected, remove or disable some of the logic in this application (review the comments for each rung to determine which logic to remove). Or, if you prefer to have the controller behave differently on a communications fault, simply add the corresponding logic that you require.

Example DNI Configuration Parameters

All example ladder logic programs in this section use the following DNI Configuration.

Parameter Number		Description	Range	Default Value	For this Example, ENTER
Series A	Series B				
4	1	Input Size	Series A: 1 to 16 Series B: 1 to 32	1 word	4 words
Not Applicable	2	Input Split Point	1 to 32	1 word	4 words
5	3	Input Type	Bit or Integer File	Integer File	Integer File
6	4	Input Data File	3 to 254	7	7
7	5	Input Word Offset	0 to 254	0	90
8	6	Output Size	Series A: 1 to 16 Series B: 1 to 32	1 word	4 words
Not Applicable	7	Output Split Point	1 to 32	1 word	4 words
9	8	Output Type	Bit or Integer File	Integer File	Integer File
10	9	Output Data File	3 to 254	7	7
11	10	Output Word Offset	0 to 254	1	95
14	11	DF1 Device	0 to 3: 0: Other 1: PLC 2: SLC/ Other MicroLogix 3: MicroLogix 1000	3 = MicroLogix 1000	3 = MicroLogix 1000
3	12	DNI Series A: Data Enable DNI Series B: I/O Scan Enable (Polling Enable)	0 or 1	Disabled (0)	Enabled (1)
12	13	DF1 Heartbeat	Series A: 2 to 10 Series B: 1 to 10	2	2
13	14	Data Scan Delay (Polling Delay)	20 to 3000 ms	50 ms	100 ms
2	15	Message Timeout	0 to 2500 ms	0 ms	0 ms
Not Applicable	16	DF1 Substitute Address	0 to 64	64 = Disabled	64 = Disabled
15	17	DF1 Autobaud	Disabled (0) or Enabled (1)	Enabled (1)	Enabled (1)
16	18	DF1 Baud Rate	0 to 5: 0: 38,400 1: 19,200 2: 9600 3: 4800 4: 2400 5: 1200	Series A: 2 = 9600 Series B: 1 = 19,200	0 = 38,400
1	19	DeviceNet Autobaud	Disabled (0) or Enabled (1)	Enabled (1)	Enabled (1)
17	**Not Applicable**	DNI Mode	Standby (0) or Operational (1)	Operational (1)	Operational (1)

Example Ladder Logic

The ladder program example is used to monitor the integrity of the communications link with the DNI. If something happens and communications are lost (cable is cut or removed, DNI loses power or faults, etc.) this logic detects that condition. The user can program the controller to respond to a loss of communications, if desired.

The example ladder logic shown below is available for download from **http://www.ab.com/micrologix**. The sample is compatible with RSLogix 500 programming software. The file name is DNI I-O.RSS and contains two programs:

DNI MicroLogix Heartbeat Logic, DNI I-O.RSS Ladder 2 - Main Program

- Monitors the communications link for integrity. This is considered to be part of the Heartbeat logic associated with the DNI.

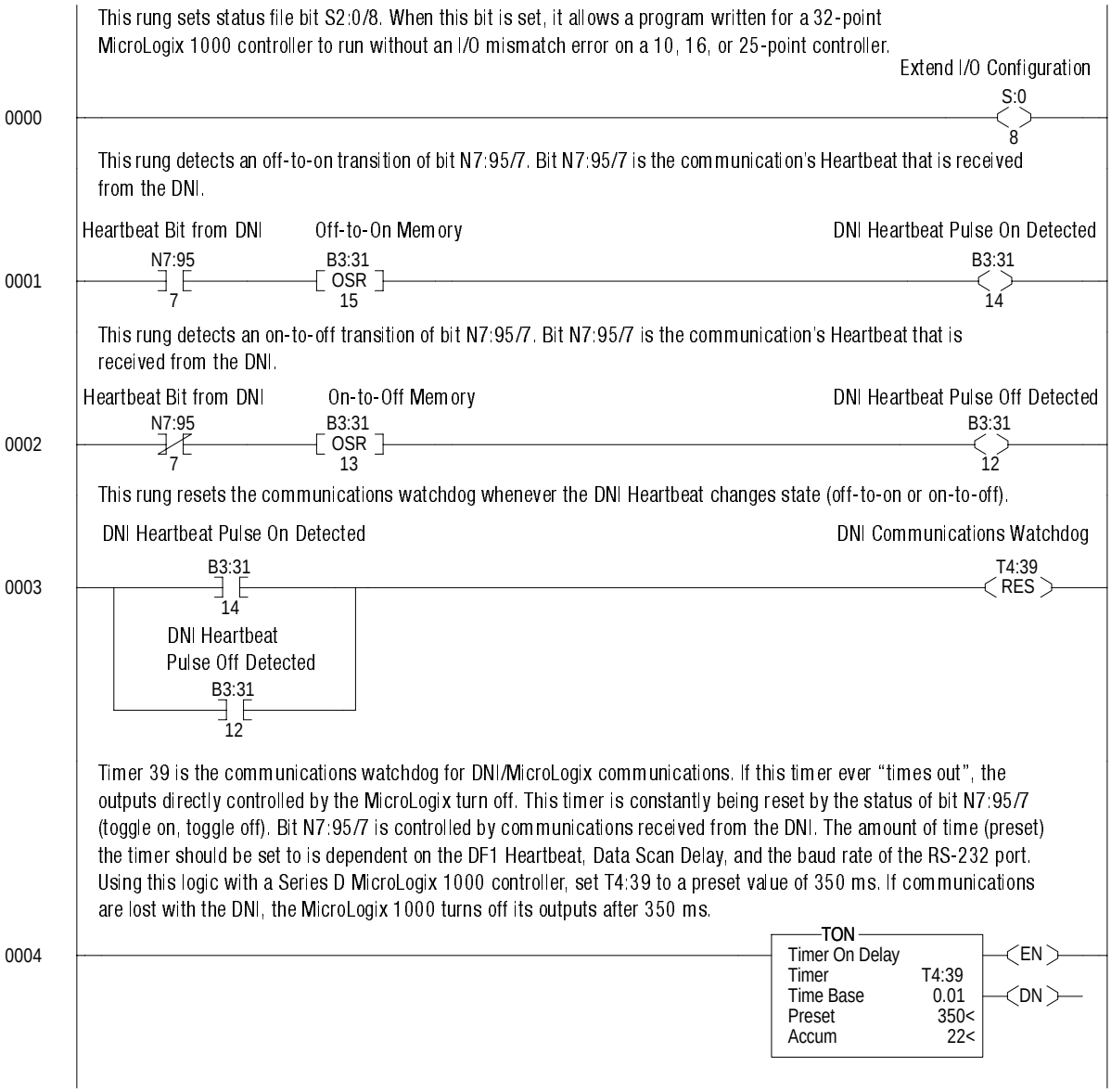
DNI - COS (change of state) I/O Messaging, DNI I-O.RSS Ladder 6 - COS ML DNI

- Moves the Input and Output data inside the controller, for correct operation with the DNI.

DNI - MicroLogix Heartbeat Logic

Note: Rung 9 in this example resets (0) all outputs to off if communications are lost. If you prefer your application to have the controller maintain the outputs in their last state, remove this rung. Or, if you want additional logic to control your outputs, remove this rung and program the outputs as your application requirements warrant.

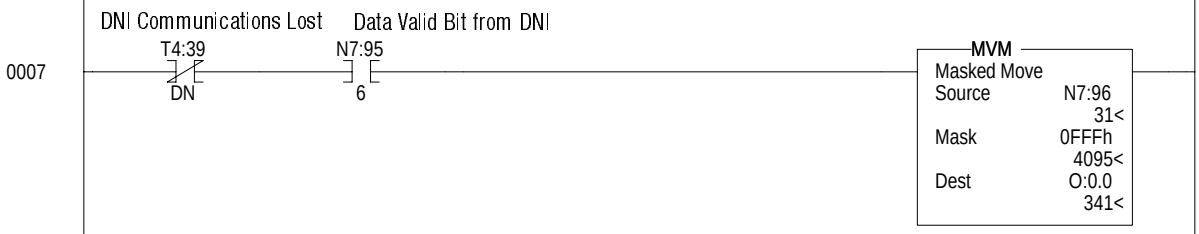
DNI I-O.RSS Ladder 2 - Main Program


This rung sets status file bit S2:0/8. When this bit is set, it allows a program written for a 32-point MicroLogix 1000 controller to run without an I/O mismatch error on a 10, 16, or 25-point controller.
Extend I/O Configuration
S:0
8
0000
This rung detects an off-to-on transition of bit N7:95/7. Bit N7:95/7 is the communication's Heartbeat that is received from the DNI.
Heartbeat Bit from DNI
N7:95
7
Off-to-On Memory
B3:31
OSR
15
DNI Heartbeat Pulse On Detected
B3:31
14
0001
This rung detects an on-to-off transition of bit N7:95/7. Bit N7:95/7 is the communication's Heartbeat that is received from the DNI.
Heartbeat Bit from DNI
N7:95
7
On-to-Off Memory
B3:31
OSR
13
DNI Heartbeat Pulse Off Detected
B3:31
12
0002
This rung resets the communications watchdog whenever the DNI Heartbeat changes state (off-to-on or on-to-off).
DNI Heartbeat Pulse On Detected
B3:31
14
DNI Heartbeat
Pulse Off Detected
B3:31
12
DNI Communications Watchdog
T4:39
RES
0003
Timer 39 is the communications watchdog for DNI/MicroLogix communications. If this timer ever "times out", the outputs directly controlled by the MicroLogix turn off. This timer is constantly being reset by the status of bit N7:95/7 (toggle on, toggle off). Bit N7:95/7 is controlled by communications received from the DNI. The amount of time (preset) the timer should be set to is dependent on the DF1 Heartbeat, Data Scan Delay, and the baud rate of the RS-232 port. Using this logic with a Series D MicroLogix 1000 controller, set T4:39 to a preset value of 350 ms. If communications are lost with the DNI, the MicroLogix 1000 turns off its outputs after 350 ms.
TON
Timer On Delay
Timer T4:39
Time Base 0.01
Preset 350<
Accum 22<
EN
DN
0004

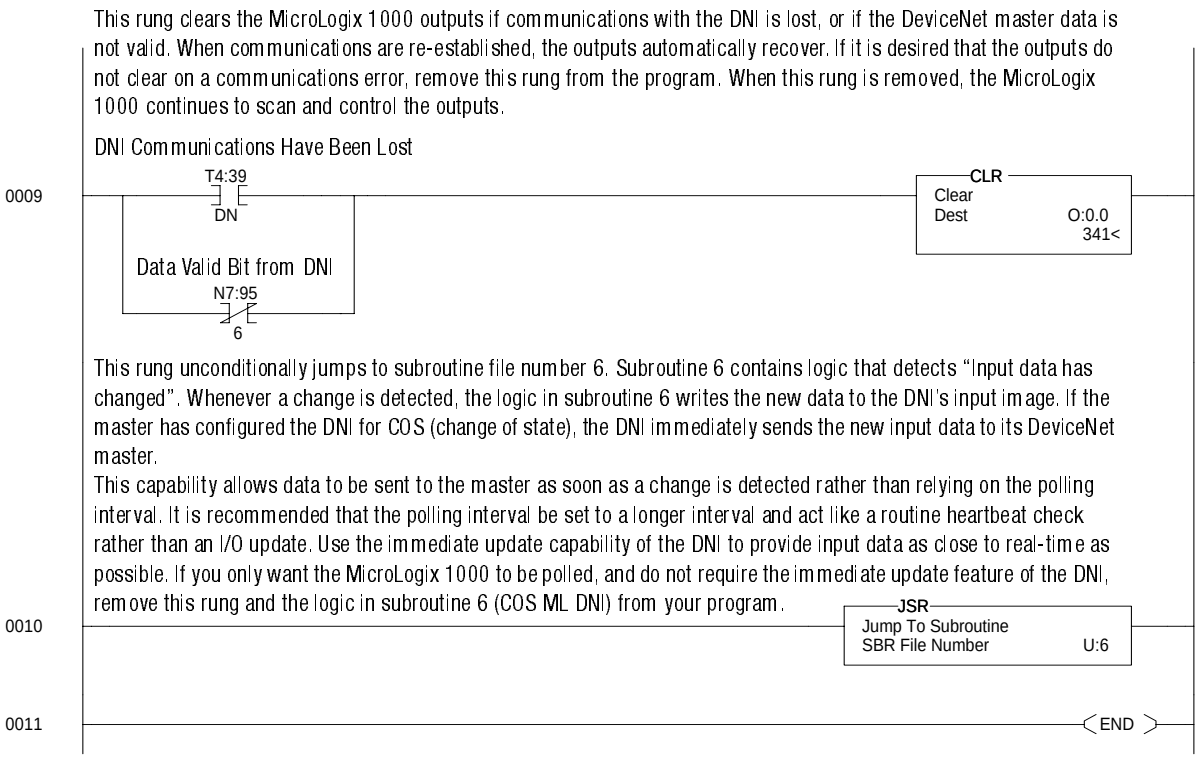
This rung moves the heartbeat bit that is received from the DNI (N7:95/7, the DNI's output) and moves its status to bit N7:90/7. Bit N7:90/7 is bit 7 of the first word of input data that the DNI receives from the MicroLogix 1000. The DNI toggles the heartbeat bit (N7:95/7) at the rate identified by the DNI Scan Delay (polling delay) x the DF1 Heartbeat.

This rung copies the MicroLogix 1000 inputs to a contiguous group of data registers in integer file 7 of the MicroLogix 1000 controller. Grouping the data allows for a faster transfer of information to the DNI. In this example, the DNI reads data using DNI parameters as follows: Input Size = 4 words, Input Type = N, File Number = 7, Input Word Offset = 90. In this example, word 90 is the status word for communications between the MicroLogix 1000 and the DNI. Input data starts at word N7:91.

This rung moves one word of output data received from the DNI (N7:96) to the outputs on the MicroLogix 1000. This only occurs if the communications watchdog has not expired and the data from the DeviceNet master is valid. In this example, the DNI writes data using DNI parameters, as follows: Output size = 4 words, Output Type = N, Output File Number = 7, Output Word Offset = 95. In this example, word 95 is the status word for communications between the MicroLogix 1000 and the DNI. Output data starts at word N7:96. If it is desired that the outputs do not clear on a communications error, remove XIO T4:39/DN from this rung. Then the MicroLogix 1000 continues to scan and maintain the outputs in their last state.



This rung moves the first six bits of N7:95 into an integer register. The first six bits of incoming data from the DNI are part of the status byte. These bits represent the node address of the DNI on DeviceNet. Moving these bits to an integer location allows the user program to determine the DNI/MicroLogix node address. In this example, the node address is stored at N7:81. Valid node numbers are from 0 to 63. If you do not need to know the DNI DeviceNet address, delete this rung.


This rung clears the MicroLogix 1000 outputs if communications with the DNI is lost, or if the DeviceNet master data is not valid. When communications are re-established, the outputs automatically recover. If it is desired that the outputs do not clear on a communications error, remove this rung from the program. When this rung is removed, the MicroLogix 1000 continues to scan and control the outputs.
DNI Communications Have Been Lost
0009
T4:39
DN
CLR
Clear
Dest
O:0.0
341<
Data Valid Bit from DNI
N7:95
6
This rung unconditionally jumps to subroutine file number 6. Subroutine 6 contains logic that detects "Input data has changed". Whenever a change is detected, the logic in subroutine 6 writes the new data to the DNI's input image. If the master has configured the DNI for COS (change of state), the DNI immediately sends the new input data to its DeviceNet master.
This capability allows data to be sent to the master as soon as a change is detected rather than relying on the polling interval. It is recommended that the polling interval be set to a longer interval and act like a routine heartbeat check rather than an I/O update. Use the immediate update capability of the DNI to provide input data as close to real-time as possible. If you only want the MicroLogix 1000 to be polled, and do not require the immediate update feature of the DNI, remove this rung and the logic in subroutine 6 (COS ML DNI) from your program.
0010
JSR
Jump To Subroutine
SBR File Number
U:6
0011
END

Note: Subroutine 6 (COS ML DNI) is covered in the following section.

DNI - COS (change of state) I/O Messaging

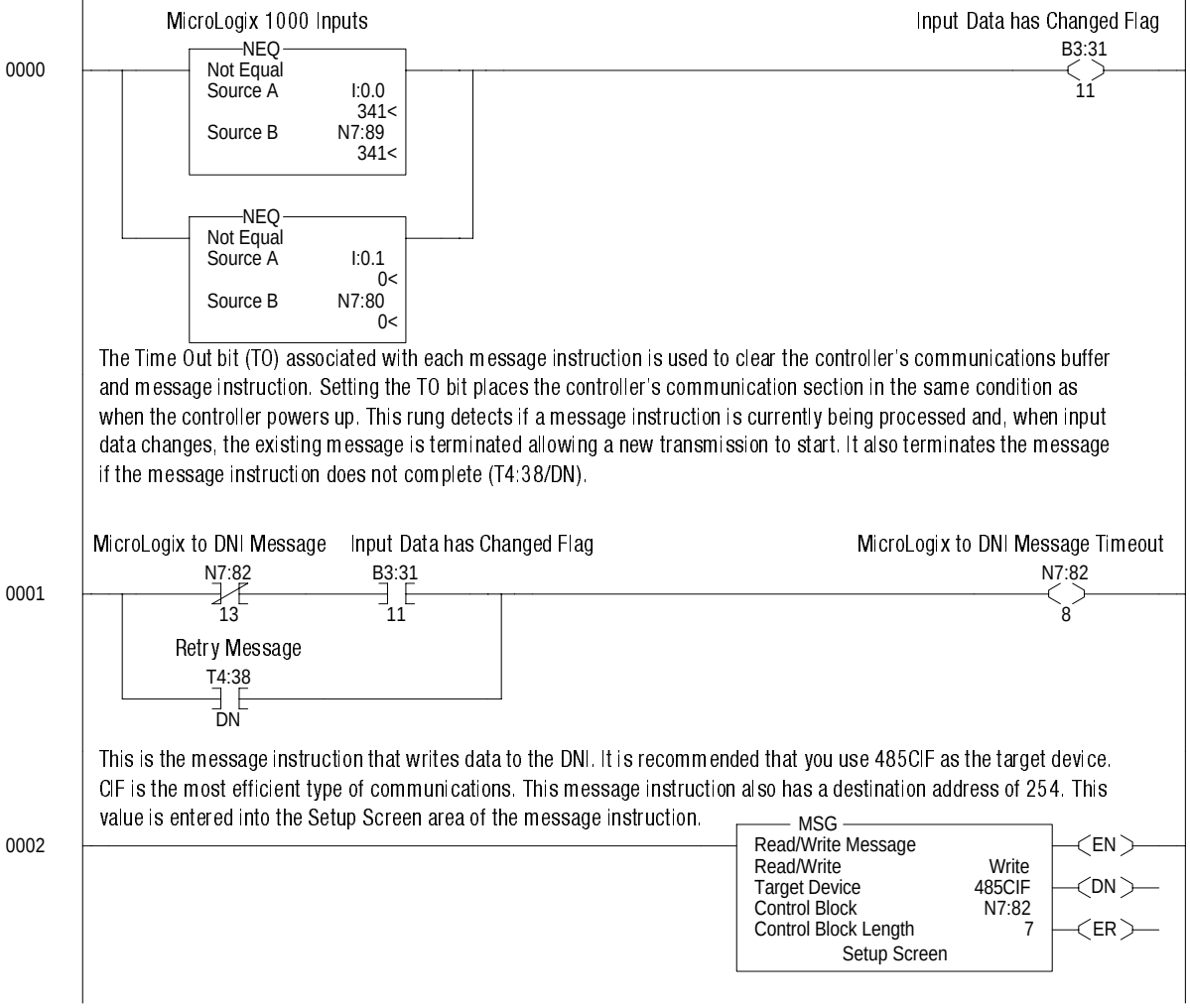
The ladder logic shown below is an example of how to send input data to the DNI (COS input messaging). This procedure is recommended because the latency issue associated with polling devices is minimized. Polling is a mechanism that is used to acquire data from a device. The DNI reading data from a controller at a set interval is an example of a polled relationship. The problem with polling is that usually the data does not change, so the communications are consumed by reading the same data over and over. Another problem is that information cannot be received quicker than the polled rate, and depending on when the data changes, worst case update can take up to twice the polled rate.

One solution to this problem is to allow for COS (change of state) messaging. What this allows is for the device (MicroLogix for example) to send input data to the DNI when it detects new/changed data. Many also call this type of relationship unsolicited communications. This can significantly improve system throughput because the polling interval is eliminated.

The way the MicroLogix controllers can get input data into the DNI is to message to node address 254. Address 254 is an invalid address on DeviceNet. When the DNI detects an incoming message, it looks at the destination address and size; if it reads 254 for the address and the size is equal to the configured input size, it knows the data in the message is input data destined for the DNI (*For DNI Series B, the size includes master and explicit input data*). The data is then placed into the DNI's input image and is delivered to the DeviceNet master using the polled or COS connection that was configured in the DeviceNet master by the user.

DNI I-O.RSS Ladder 6 - COS ML DNI

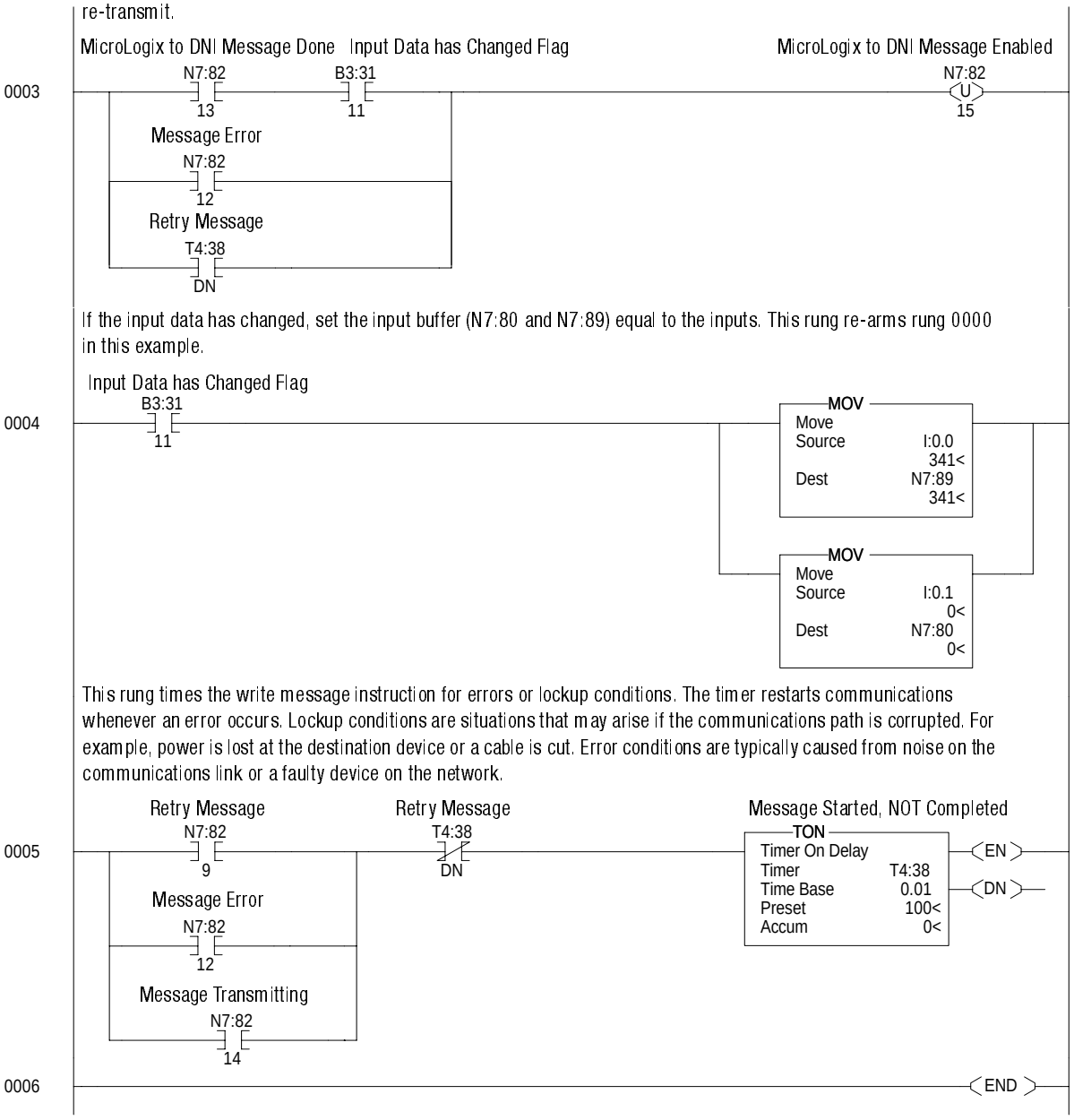
This rung checks to see if the input data has changed from the previous ladder scan. If the input data has changed, bit B3:31 is set.



The Time Out bit (TO) associated with each message instruction is used to clear the controller's communications buffer and message instruction. Setting the TO bit places the controller's communication section in the same condition as when the controller powers up. This rung detects if a message instruction is currently being processed and, when input data changes, the existing message is terminated allowing a new transmission to start. It also terminates the message if the message instruction does not complete (T4:38/DN).

This is the message instruction that writes data to the DNI. It is recommended that you use 485CIF as the target device. CIF is the most efficient type of communications. This message instruction also has a destination address of 254. This value is entered into the Setup Screen area of the message instruction.

The rung is used to reset a completed or errored message instruction. Resetting the MSG instruction will re-arm it to re-transmit.



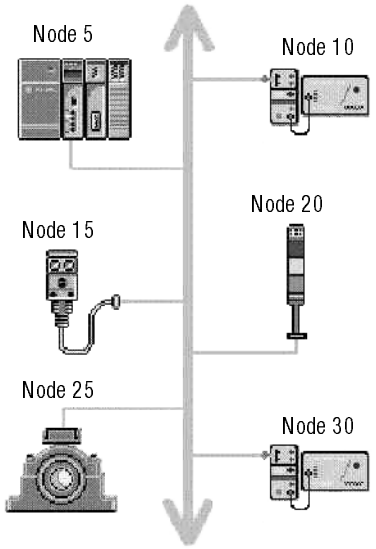
If the input data has changed, set the input buffer (N7:80 and N7:89) equal to the inputs. This rung re-arms rung 0000 in this example.

This rung times the write message instruction for errors or lockup conditions. The timer restarts communications whenever an error occurs. Lockup conditions are situations that may arise if the communications path is corrupted. For example, power is lost at the destination device or a cable is cut. Error conditions are typically caused from noise on the communications link or a faulty device on the network.

Explicit Messaging (DNI Series B Only)

Explicit messaging is the mechanism that is used to move data over DeviceNet. Every device on DeviceNet either initiates or responds to some type of explicit message to either read (get) or write (set) data.

In the network shown below, node 5 is a master (scanner) that owns slave I/O data on the DeviceNet network. When the master interacts with its slaves (either through strobed, polled, cyclic or COS connections), the communications used are specific types of I/O messages. If the MicroLogix controllers at nodes 10 and 30 want to exchange data, they message through the DNIs to each other using explicit messages.



The functionality of each device determines how it can interact with other devices on the network. Many devices can only respond to requests. Some devices can be configured to respond, but they can also initiate messages to others. One example is the PanelView operator interface that has DeviceNet built in. It can be owned by a master as slave I/O, and can also get or set data to other devices on the network.

The Series B DNI also has the ability to exchange data with other DeviceNet devices using explicit messaging, provided those devices are capable of interacting. Some of the requirements include:

- If a device is Unconnected Message Manager (UCMM) capable, it should be 100 percent compliant with or without a master being present on the network.
- If a device is not UCMM capable, it will need a master to be present on the network, and it should be owned by the master.
- If a device is not UCMM capable and a master is not present (or a master is present but the device is not owned by the master), the device will not be compatible with the DNI using explicit messaging.

Using DF1 Protocol for Explicit Messages Over DeviceNet

The DNI is an intelligent bridge between DF1 Full Duplex (Allen-Bradley open protocol) and DeviceNet. All Allen-Bradley controllers that use DF1 protocol (basically any Allen-Bradley controller with an RS-232 port) use the historical source/destination model to move data.

The problem with this is that DeviceNet uses the newer producer/consumer model and is not compatible with the source/destination model. So, to allow controllers that use the source/destination model (MicroLogix, SLC, PLC) access to devices on DeviceNet, the DNI can act as an intermediary.

To act as an intermediary, the DNI must allow the historical DF1 message format to be compatible with the newer DeviceNet producer/consumer object model. This is accomplished by creating a routing profile. The routing profile basically takes the DF1 message and converts it to DeviceNet. Each routing profile contains the information needed to get or set data to other DeviceNet devices.

Each routing profile has five components:

- Node - The address of the Device on DeviceNet
- Class - The DeviceNet class code
- Instance - The DeviceNet instance code
- Attribute - The DeviceNet attribute code
- Size - The amount of data to be read or written

The DNI can store up to 10 profiles. These profiles can be changed at any time, and they are not backed up with a battery. If the power to the DeviceNet network is lost, the profiles are cleared and must be reloaded. This can be done with a subroutine.

Note: A message instruction returning an error code of 0xD0H is an indication that profiles need to be re-configured.

Routing Profile Configuration

The 10 profiles stored within the DNI in *profile registers*. To configure a routing profile, the user creates a write message in the controller's ladder logic with a destination node address of 240 to 249. The write message must have a data length of five words. Each word corresponds to one of the five components in the routing profile, as follows:

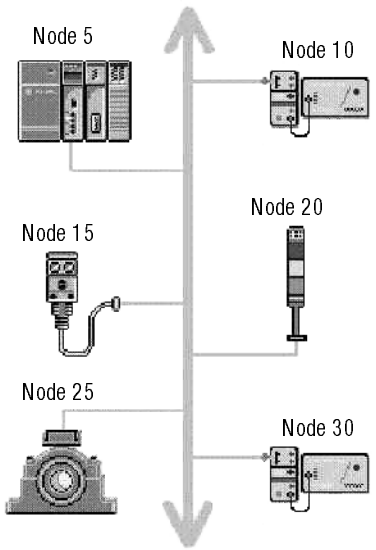
Word	Title	Function
0	Target Node	Node number (0 to 63) of the target device on DeviceNet that communications will be established with.
1	Class	Class of the target DeviceNet object.
2	Instance	Instance of the target DeviceNet object.
3	Attribute	Attribute of the target DeviceNet object that will be read from or written to (get/set).
4	Size	Amount of data to be read or written in bytes.

When the DNI receives a write message with a destination address of 240 to 249, it stores the five words of data in the corresponding profile register, location 240 to 249.

Explicit Messaging Examples

Once the profiles are correctly loaded into the DNI, getting data from a DeviceNet device is as simple as reading data from another controller. The procedure is illustrated by the following examples.

Reading (Get) Data Example



For the DeviceNet network shown above, we want to read data from the proximity sensor at node 15. The proximity sensor has specific DeviceNet parameters that are accessible via the DeviceNet network. In this example, profile register 240 within the DNI (node 10) has been configured to access specific data within the proximity sensor.

Note: Devices must be UCMM capable. The proximity switch and tower light are not UCMM capable. But, because they are owned by the 1747-SDN scanner in the SLC chassis, the DNI can explicit message to them.

Note: Any devices parameters should be identified in their respective documents.

DNI Profile Register 240:

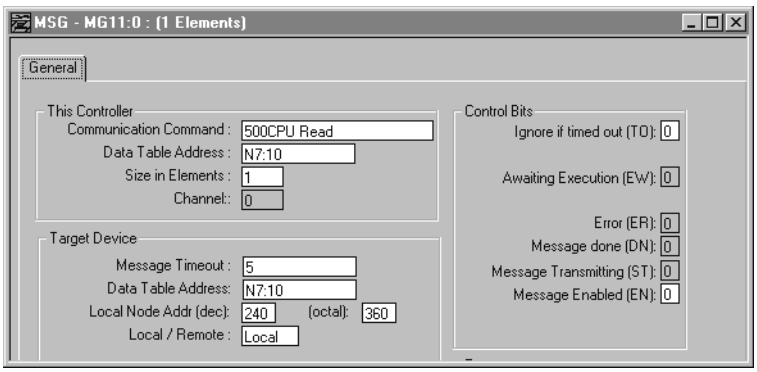
- DeviceNet Node:15
- Class: 14 (0x0E)
- Instance: 1
- Attribute: 1
- Size: 1 byte

To read data from the proximity sensor, a read message is initiated from the controller to node address 240. The DNI receives the node 240 read request and then generates the appropriate DeviceNet explicit message to get (read) data from the proximity sensor at node 15.

Note: The profiles size parameter *must* match the DeviceNet device.

In this example, the amount of data (size) being read over DeviceNet (*in bytes*) is 1. The DNI receives the byte of information from the sensor and replies to the controller read request with a *word* of data. The actual byte of data from the sensor resides in the low order byte of the data word within the controller.

In this example, the read message instruction has N7:10 identified as the data table address, so the sensor data will appear in low order byte of N7:10. The message instruction setup screen is shown below.

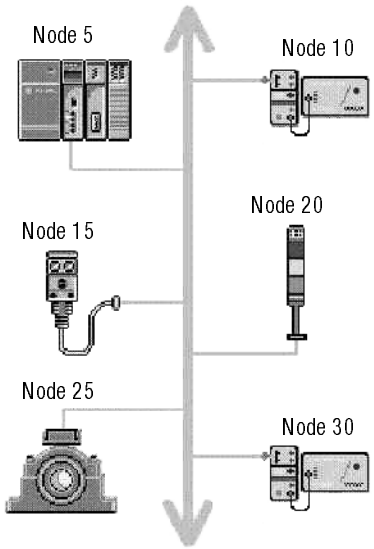


Writing (Set) Data Example

In this example we want to write data to the light tower at node 20. The light tower has specific parameters that are accessible via the DeviceNet network. In this example, profile register 241 within the DNI (node 10) has been configured to set data in the light tower:

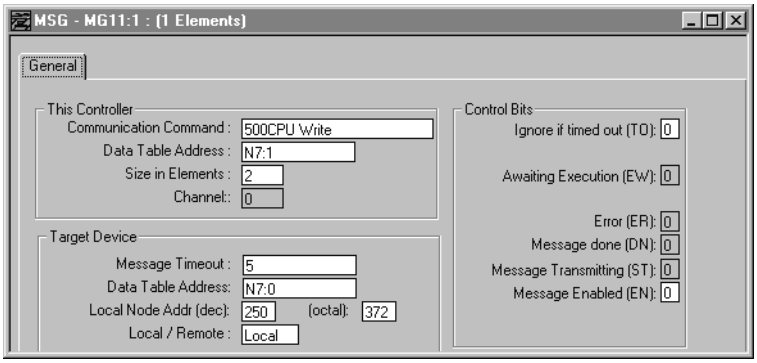
DNI Profile Register 241:

- DeviceNet Node:20
- Class: 9
- Instance: 1
- Attribute: 3
- Size: 1 byte



To set DeviceNet data, a write message is initiated from the controller to node address 250. The first data word of the write message identifies which profile register to use (240 to 249). The remaining data words in the message contain the data that is transmitted to the DeviceNet device, in this example the light tower.

The size specified in the DNI's profile register is in *bytes*. The data being sent by the controller is in *words*. In this example N7:0 contains the profile register to be used (241). Location N7:1 contains the data to be sent to the light tower. The message instruction setup screen is shown below.



The actual data portion of the controller's write message (N7:1) must match the size parameter in the respective profile register. In this example:

- the size of profile register 241 is 1
- the controller's write message has a length of 2
  - the first word identifies the profile register to be used
  - the second word is the actual data

To verify that this is a valid routing profile, we see that the data portion of this message is 1, which corresponds to the profile's size of 1. So, this example is valid. If the sizes do not match, the controller's write message will result in an error.

Specifications

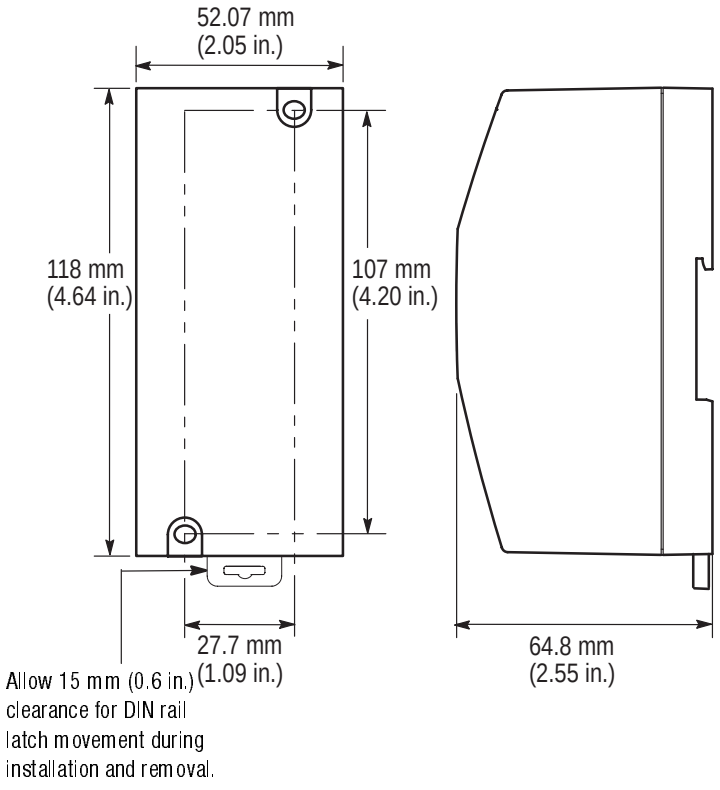
Physical Specifications

Description	Specification
24V dc Power Source Required	11 to 25V dc
Current Draw	200 mA at 24V dc 350 mA at 11V dc (400 mA maximum inrush for 30 ms at 24V dc)
Internal Isolation	500V dc
Ambient Operating Temp.	0°C to +60°C (+32°F to +140°F)
Storage Temperature	-40°C to +85°C (-40°F to +175°F)
Agency Certification	UL 1604 C-UL C22.2 No. 213 Class 1 Division 2 Groups A,B,C,D CE compliant for all applicable directives ODVA Conformance Version 2.0

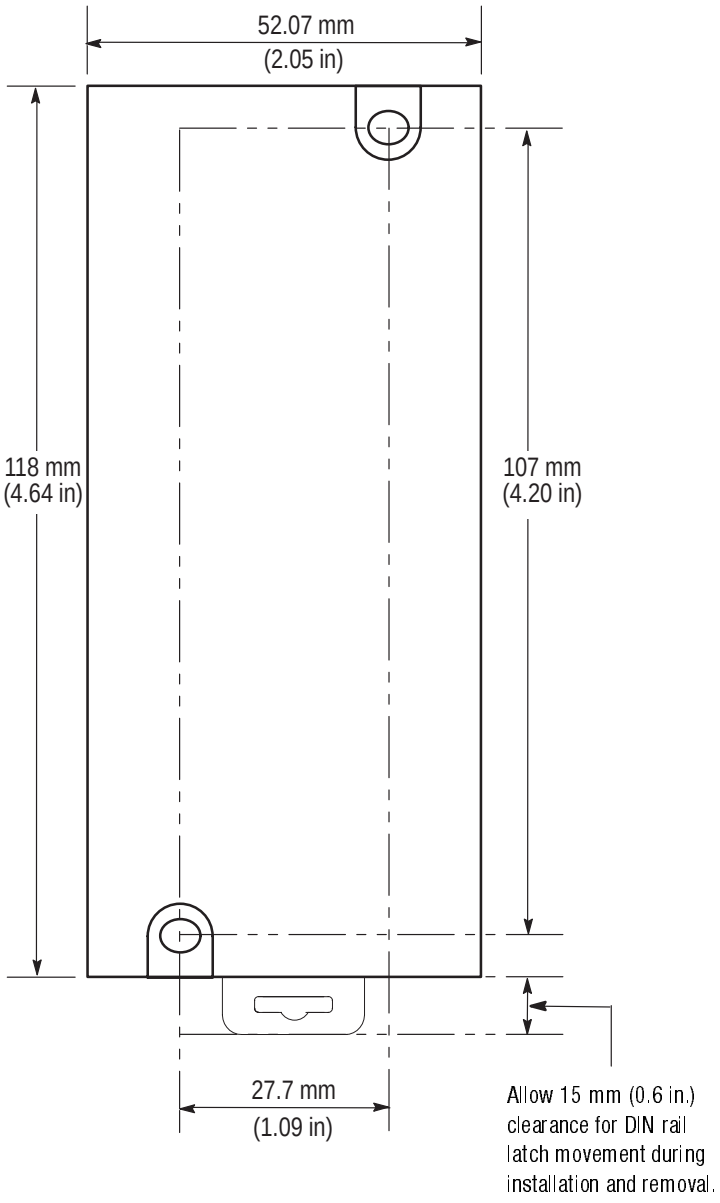
DeviceNet Specifications

Feature	Y/N	Comments
Peer to Peer Messaging	Y	Only to other Controllers/DNI's
I/O Assembly Explicit Messaging	Y	Output sets only when I/O connection set is unowned
I/O Peer to Peer Messaging (also known as Dynamic I/O)	N	
UCMM	Y	
Configuration Consistency Value	Y	
Deferred Delete	Y	
Faulted Node Recovery	Y	
DeviceNet Auto-Baud	Y	
Flash Upgradeable	N	
Baud Rate	All	125K, 250K, 500K
Master/Scanner	N	
I/O Slave: Bit Strobe Polling COS (change of state)	Y N Y Y	
Flat cable		TBD

Dimensions


52.07 mm
(2.05 in.)
118 mm
(4.64 in.)
107 mm
(4.20 in.)
27.7 mm
(1.09 in.)
64.8 mm
(2.55 in.)
Allow 15 mm (0.6 in.)
clearance for DIN rail
latch movement during
installation and removal.

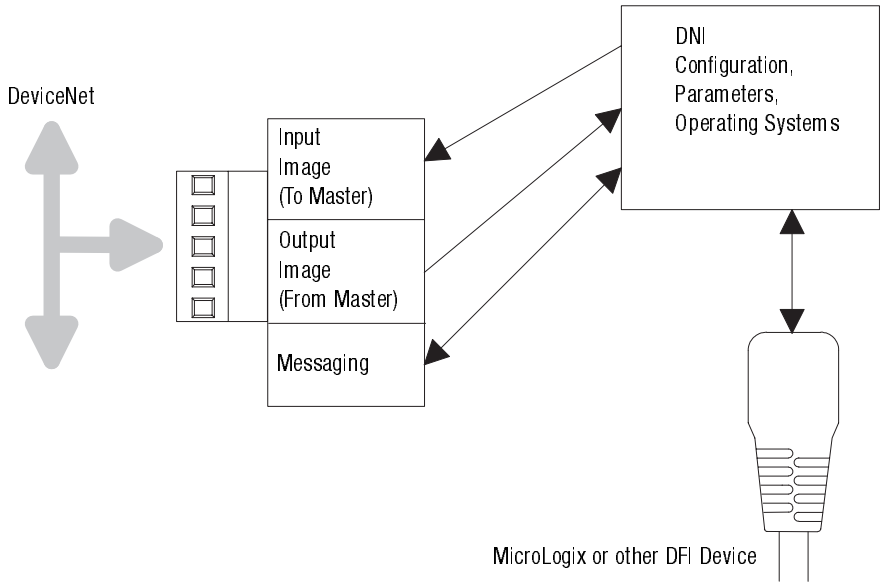
Mounting Template



Interface Basics

The 1761-NET-DNI (DNI) is a smart interface that provides DF1 Full Duplex capable devices a connection to DeviceNet. To understand how the DNI operates, you need to become familiar with certain terms. The figure below illustrates the relationship between the DF1 Device, the DNI function, and the DeviceNet network.

1761-NET-DNI Interface Diagram



Terms and Abbreviations

The following terms and abbreviations are specific to this product. For a complete listing of Allen-Bradley terminology, refer to the *Allen-Bradley Industrial Automation Glossary*, publication AG-7.1.

Autobaud
A feature that allows a communications port to automatically synchronize to the device or network that it is attached to. This feature typically minimizes the amount of configuration required, and also makes it easier to replace devices.

Connection Set
These methods of communication relate to how data is communicated between master and slave. For example, a master allocates a slave I/O connection set. The ownership allows the master to read (get) and/or write (set) data to the slave.

COS (Change Of State)
Communication method that does not send or receive data until a change in data is detected.

DeviceNet Master
A product capable of owning input/output (I/O) on DeviceNet.

DeviceNet Slave
A product whose data (or portion of) can be owned by DeviceNet Master.

DF1 Full Duplex
DF1 is a standard (open) point-to-point communication protocol. Virtually all Allen-Bradley controllers (PLC-3®, PLC-5R®, SLC, MicroLogix) that support an RS-232 communications port support DF1.

Explicit Messaging
A DeviceNet message which gets/sets device configuration information.

Heartbeat
A mechanism that allows a device, set of devices, or a connection to check for operation or integrity. Also known as a watchdog.

Input Buffer
A set of 16-bit words that is available to a Master on DeviceNet. The input buffer in DNI Series A is configurable from 1 to 16 data words (DNI Series B is configurable from 1 to 32). The data in the input buffer originates from the device connected to the RS-232 port (either by the DNI reading the data, or the RS-232 device writing the data to the DNI). The input buffer terminology is used because the data is *input data* to the DeviceNet Master.

Messaging
A general term that identifies the exchange of data between devices. The two major types of DeviceNet messaging are:

- I/O - DeviceNet master and DeviceNet slave.
- Peer-to-Peer - Between compatible devices without a master's involvement.

Output Buffer
A set of 16-bit data words that is available to a Master on DeviceNet. The output buffer in DNI Series A is configurable from 1 to 16 data words (DNI Series B is configurable from 1 to 32). Output data received from the DeviceNet master is forwarded (written) to the RS-232 device.

Peer-To-Peer
A type of communication where both devices are equal. These devices communicate to each other without a third device to manage the transaction.

Profile Register
The location within the DNI where routing profile configurations are stored.

PCCC
Programmable Controller Communications Commands

UCMM
Unconnected Message Manager

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